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A MONOGRAPH OF THE GENUS PHOLIOTA IN THE UNITED STATES

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I. Aims and Methods

Several years of study of the higher Basidiomycetes have brought to the writer the conviction that until very recently mycologists have overlooked many of the important details in the structure of these plants. No genera are more significant in this respect than *Corticium*, *Peniophora* and *Hymenochaete* of the *Thelephoraceae;* *Flammula*, *Hypholoma* and *Pholiota* of the *Agaricaceae;* and *Lycoperdon* and *Bovista* in the *Lycoperdaceae*. In these and in many other (perhaps nearly all) genera the microscope reveals contrasting details of structure that were entirely unknown to the earlier generations of mycologists. These details have been so much neglected that it may be truthfully said that the current conception of species in fungi has lagged considerably behind that of seed plants. Many of the so-called species in our mycological literature have been in reality species complexes. While it must be admitted that specific limitations must always be to some extent a matter of individual opinion, yet undoubtedly taxonomists will more nearly agree in these opinions when the details of structure become a part of the current knowledge about these plants. The facts concerning them should be set in orderly array, open to the inspection and criticism of all. Descriptions alone will not so present them. Much may be said against

running each description, as it were, into a mold or through a mill, hewing them all down to the same thickness and cutting them all off to equal length; yet after all it is the only way to make the plants stand in contrast to each other. How often one comes upon a descriptive item that he suspects may be of prime importance, only to find, when seeking a contrast with another species, that no mention is made of the presence or absence of this characteristic. Single points of difference do not usually make a species, to be sure; therefore, all the more reason for available diagnoses that will enable one to contrast two or more species on all points. It is the aim of this paper to so contrast in particular the microscopic details within one genus of the Basidiomycetes.

The paper is the outgrowth of a critical study of the species of the genus *Pholiota* of the *Agaricaceae* for the 'North American Flora.' The drawings illustrating the microscopic details are all made to the same scale in the different species so that direct comparisons can be made. All were outlined under the camera lucida from free-hand transverse sections of the gills of dried plants after softening with alcohol and water, mounting in KOH, and staining with dilute eosin. The larger drawings of the spores were made in the same way except under the oil-immersion lens, yielding a magnification of about 1800 diameters. The spore measurements represent normal variations of what are believed to be mature spores, a series of usually not less than 10 spores being measured for each species.

II. HISTORICAL

Only very recently has this genus received critical study at the hands of American mycologists. In 1908 Peck published[1] one of his latest and best monographs, dealing with this genus in the state of New York. It was followed in 1912 by the work of E. T. Harper[2] on the species occurring in the region of the Great Lakes and to which additions were made in two subsequent papers.[3] The illustrations published by him constitute the finest

[1] Bull. N. Y. State Mus. 122: 141–158. 1908.
[2] Trans. Wis. Acad. Sci. **17**: 470–502. 1912.
[3] *l. c.* **17**: 1011–1014. 1913; **18**: 392–405. 1916.

work of the kind that has appeared in America. Yet his descriptions were in many cases inadequate, though possessing the advantage that many of them were drawn from the plants as he found them growing in nature. Yet many were only quotations from the earlier work of Peck. His most important contribution, aside from the illustrations, was the fact, presented for the first time, that the species may be grouped into phylogenetic units with rather well-marked characteristics for each group, the species within these units differing in lesser degree. The importance of this grouping cannot be ignored yet can be over-emphasized to the confusion of one not well acquainted with the genus. Without access to material of authentic European species he was forced to rely on published descriptions, and to some extent he was misled by erroneous identifications by others. In 1918 appeared Kauffman's work[1] on the gill fungi of Michigan in which the species were well described but inadequately illustrated.

The contribution that I have attempted to make in the present paper has been largely in the matter of the details of microscopic structure of the hymenium. It is a matter of constant surprise to see how easily species may be separated by this means; and by a combination of microscopic and macroscopic characters most of the species take their place with a definiteness that is remarkable. Even where macroscopic features are in themselves characteristic enough to delimit species it is reassuring to be able to confirm a determination by a set of facts deduced from an entirely different source.

While this sort of work cannot be said to be a new angle of attack for taxonomic work in the higher Basidiomycetes, yet instances where it has been systematically used in the gill fungi are remarkably scarce and no instance has come to my attention where the microscopic characters have been enumerated and illustrated to a sufficient extent in a single genus of that group. The nearest approach to this has been in the work of Lange on the Agarics of Denmark.[2] However, the illustrations there are

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[1] The Agaricaceae of Michigan. Mich. Geol. & Biol. Surv. Publ. **26:** 1–899. 1918.

[2] Lange, J. E. Studies in the Agarics of Denmark. I. The genus Mycena. (Dansk Bot. Arkiv **1**[5]: 1–40. 1914); II. Amanita. Lepiota. Coprinus. (*l.c.* **2**[3]: 1–53. 1915); III. Pluteus. Collybia. Inocybe. (*l. c.* **2**[7]: 1–50. 1917); IV. Pholiota. Marasmius. Rhodophyllus. (*l.c.* **2**[11]: 1–46. 1921.)

woefully inadequate on this point so that the entire effect is not much better than the rather complete descriptions of microscopic characters presented by Kauffman.

III. PREPARATION OF THE KEYS

In preparing the key to species I have been at some loss to know on what points to make the larger divisions. A number of possibilities present themselves for consideration. Previous writers have for the most part attempted to follow the scheme outlined by Fries, making the first division on the basis of habitat. I have attempted to use the point of comparative sizes instead. In any scheme there will always be some overlapping. At first thought it might appear that in using habitat there can be no overlapping, for either the plants grow on wood or else they grow on the ground. Yet in reality the matter is not so simple. Some species grow on earth heavily charged with humus or very rotten wood; some grow from buried wood, and in either case, unless great care is exercised at all times in the field, the collector will be at a loss to know how to refer his habitat or if unobservant will name it wrongly. The weak point about most keys lies in the failure to take into consideration these overlapping forms, and when that is properly cared for the exact point on which the division is made becomes of secondary moment, unless, of course, one is interested in showing phylogenetic relationships in the key. But phylogeny assumes or demonstrates similarities, and the purpose of a key is to show contrasting differences. It is impossible, therefore, to combine these opposing views in one key with any high degree of satisfaction.

IV. MICROSCOPIC OBSERVATIONS

Both in the keys and in the descriptive matter I have laid considerable emphasis on the cystidia and the spores. The cystidia in this genus fall for the most part into three general categories. These are represented as follows: (1) Text figures 1, 3, 5, 9, 15, etc., in which they are enlarged and quite conspicuous, varying from almost round to fusoid. This type might in fact be broken into two types, one that does not present a narrowed apex and one that does. Yet they intergrade to a considerable extent. (2) Text

figures 40, 43, 46, 83, 87, etc., in which the buried base is enlarged into a bulb, and the apex, that may be long and cylindrical, projects prominently beyond the basidia. (3) Text figures 127, 129, 131, 135, 137, 139, etc., in which they are brown in color, particularly in dried plants, and do not usually project prominently, sometimes not at all. It has not been deemed expedient to illustrate the fact that these last bodies are colored except in figs. 127, 129, and 135, where they have been darkened slightly. At least in the key, measurements in diameter of all of these bodies are measurements through the broadest part, which is usually imbedded between the basidia. In the matter of spore sizes rather narrow distinctions have been drawn in the keys at times, and careful measurements of several representative spores should be made before conclusions are reached. In general, the smallest spores, except in cases where spore prints have been obtained, should be disregarded, especially if they appear somewhat lighter in color, since such are obviously immature. Spore markings, if present, can usually be detected with the ordinary high power of the microscope, especially if a 10 × or a 12 × ocular be employed. In such cases, definite indications of roughness on the part of *some* spores indicate that they should be classed as roughwalled. An oil-immersion lens is a convenience in substantiating roughness where dry-lens examination is not conclusive. Emphasis has also been laid on the appearance of a slight degree of truncateness on one end of the spore in some cases (figs. 2, 8, 14, 95, etc.). This is usually an obscure point at first, but once detected it can be rather readily recognized under the high-power dry lens. That this truncateness is in reality on the apex of the spore and does not represent its point of attachment to the sterigma, as would at first appear, has been repeatedly verified.

V. Nomenclature and Synonymy

In the matter of nomenclature and synonymy I have used, for all my plants, names that have been current in the present generation of mycologists, without attempting in any case to replace well-established names with those of an earlier and often a doubtful designation. I have, however, not hesitated to use current European names in place of names of an American origin when

I have been able to satisfy myself of their equivalence. I consider the genus to have been established to all intents and purposes by Fries in the 'Systema Mycologicum' in 1821. For the rest I have followed the International Code in the matter of citations.

VI. PHYLOGENETIC CONSIDERATIONS

As has been mentioned on a preceding page, the species of *Pholiota* fall into several rather well-marked phylogenetic units, each with a central species around which the others may be grouped. It may or may not be possible to select the central species which would represent the ancestral types of the group in each case, and the evolutionary development within a group may not have taken place symmetrically but may have been all in one general direction, but the fact remains that the species within any one of these groups are more closely related to each other than they are to the members of any other group. The recognition of these groups is a relatively easy matter, since in most cases they do not intergrade. On the other hand, the boundaries of the more recently recognized types within these groups are often quite a difficult matter, since they are not always sharply delimited. In the matter of marking out these more elementary species, individual opinion must always play an important part, and for that reason different investigators may not always come to the same conclusion.

Since in the presentation that constitutes the bulk of this article attention is directed to only the fundamental taxonomic features, I shall here briefly consider these phylogenetic units within the genus. Relationships are expressed in similarities in what are believed to be the more significant and deep-seated characters, and those that are less likely to vary under varying external conditions. Two of the most important of these are the spores and the cystidia. For example, the peculiar truncate spore and the large cystidia, all of the same type and different from almost all others in the genus, are to me a mark of relationship between *P. dura*, *P. praecox*, *P. vermiflua*, *P. temnophylla*, *P. Howeana*, and *P. Acericola*. It so happens that these species agree also, at least in a general way, in several other characters, e.g.,

general form and coloration, habitat, absence of all scaliness, etc. In the same way there is a small group centering around *P. erebia* that shows close agreement in spore characters and in the characteristic cystidia with long projecting necks. Here again, other points, less easy to express quantitatively, leave no doubt that we are dealing with a group of closely related species, and far more closely related among themselves than to individuals of any other group. But only about 80 per cent of the species here treated show similarities by which they can be so grouped at present. The remainder must be carried as unattached species, perhaps in some cases representing a non-plastic or stabilized condition, at least temporarily. Some of the forms that I have left unattached were given more definite placings by Harper, to which I cannot subscribe. These exceptions have been noted in the tabulation that follows. Harper recognized twenty such groups or phylogenetic units, several of them monotypic and several not designated by name. After the first dozen have been marked out the remainder are found to be more problematic. My own interpretation of the situation at present follows.

In the first place, authors since the time of Fries have rather consistently recognized two large divisions of the genus on the basis of habitat. These are the sections that have been designated as the *Humigeni* and the *Truncigeni*, since their members occur on the ground and on wood, respectively. Two or three species are limited to a muscigenous habitat and have been designated as the *Muscigeni*. Within these large divisions the phylogenetic units appear as follows:

SECTION I. HUMIGENI

1. The Praecox Group.[1]—With prominent broad cystidia and spores truncate at the apex. General color ochraceous or paler. No scales on pileus.

P. praecox, P. vermiflua, P. Howeana, P. temnophylla, P. Acericola (also *P. dura* of Europe).

While *P. Acericola* frequently grows on rotten wood and perhaps

[1] Items are to be taken as characteristic of the groups in which they are mentioned. Therefore in using this synopsis as a key the plant is to be placed in that group with which its characters best agree regardless of whether or not these are stated as contrasting characters for the groups.

never on the bare ground, all of its other characters ally it with this unit. Harper puts *P. Howeana* into a separate section with *P. ventricosa* (= *P. spectabilis*), to which I cannot subscribe.

2. The Togularis Group.—Without cystidia. Spores truncate (except in *P. blattaria*, at times). Ochraceous or paler in color, and small in stature, with a median membranous annulus striate on the upper surface.

P. togularis, P. blattaria, P. rugosa, P. filaris.

Harper includes *P. anomala* in this group. I have included it among the unattached species.

3. The Erebia Group.—Spores elongate-elliptic, 10–15 μ long, not truncate. Cystidia abundant, flask-shaped with long necks.

P. erebia, P. ombrophila, P. subnigra, P. platyphylla.

4. The Caperata Group.—Spores rough. Cystidia none. Pileus orange-cinnamon or ochraceous-orange. Plants of rather large stature.

P. caperata, P. Mcmurphyi.

Harper includes *P. Johnsoniana* here, but its characters make it quite distinct in my opinion.

5. The Terrestris Group.—Spores smooth, less than 10 μ long. Cystidia rather indefinite but some sterile bodies present and recognizable. Pileus scaly with small scales.

P. terrestris, P. angustipes.

This group may not be a natural one but does show some transition over towards the *Truncigeni*. While not known to grow on wood, the latter species grows around stumps and is likely attached to buried wood. *P. terrestris* may eventually show such an attachment, and both species bear in the hymenium a very simple and inconspicuous type of sterile body that resembles to a degree those of the *Adiposa* section of the *Truncigeni*. However, the group is advanced with some misgivings. *P. albivelata* could be forced into the same alliance were it not for the entirely glabrous and viscid pileus. If it were admitted, *P. anomala* might be included also. *P. trachyspora* would be included were it not for its rough spores.

Unattached Species of the Humigeni.—(1) *P. albivelata.* A rather

anomalous species that might stand as the type of a distinct group. (2) *P. anomala.* Too indefinite to place and may prove to be referable to an older species. My study of the types would deny its inclusion in the *Togularis* group as referred by Harper. (3) *P. aurea* is difficult to interpret. It may grow attached to buried wood and belong in the *Truncigeni* as would be indicated by its color. (4) *P. duroides* and *P. Johnsoniana* might be regarded as constituting a distinct group near the *Praecox* group but neither would seem to belong well in that unit. Harper so refers *P. duroides* and unites *P. Johnsoniana* with the *Caperata* group, very evidently an erroneous conception.

SECTION II. TRUNCIGENI

6. The Marginata Group.—Spores mostly slightly rough at maturity. Cystidia present, flask-shaped, with a narrow projecting neck (fig. 83). Rather small plants, with glabrous, hygrophanous pileus, striatulate when moist, watery-brown, drying to ochraceous or cinnamon.

P. marginata, P. unicolor, P. discolor, P. furcata.

Harper includes *P. marginella* and *P. mutabilis* here, but they differ in having slightly truncate spores and in lacking cystidia.

7. The Mutabilis Group.—As in the *Marginata* group but spores slightly truncate, smooth, and cystidia absent.

P. mutabilis, P. marginella.

8. The Cerasina Group.—Reddish or ochraceous-orange species with glabrous pileus, not hygrophanous. Cystidia none. Spores smooth or rough.

P. cerasina, P. oregonense, P. rubecula.

9. The Spectabilis Group.—Gills bright-colored (yellow or ochraceous-orange and remaining so on drying). Pileus dry, scaly. Spores rough.

P. spectabilis, P. luteofolia, P. aeruginosa, P. curvipes (?).

10. The Adiposa Group.—Spores smooth. Pileus often viscid, decidedly scaly. Stem usually scaly. With brown cystidia in the hymenium. Large plants, fleshy and heavy, yellowish colors predominating.

P. adiposa, P. aurivella, P. aurivelloides, P. squarrosa, P. squarrosoides, P. flammans, P. rigidipes.

I have united here two groups, the *Adiposa* group and the *Squarrosa* group of Harper, although they can be maintained distinct on the basis of the different type of scaly covering on the pileus. *P. limonella,* I would prefer to class in the *Tuberculosa* group, rather than here as in Harper's synopsis. *P. flammans* departs from the other species of the group in the small stature and the small spores. *P. rigidipes* has all of the characters of this group except for the sparsely scaly pileus and stem, and the more slender stature.

11. The Tuberculosa Group.—Spores smooth. Pileus viscid, and both pileus and stem scaly. No cystidia. Small plants of bright color, red or orange predominating.

P. tuberculosa, P. lucifera, P. limonella.

P. curvipes might be expected here rather than in the *Spectabilis* group, but departs from the characters enumerated above in the lack of viscidity on the pileus.

12. The Muricata Group.—Small plants with erect-pointed dark scales on pileus and stem. No cystidia. Spores smooth.

P. muricata, P. erinaceella.

13. The Fulvo-squamosa Group.—Large plants with fibrous cuticle that soon separates into scales. Not viscid. Spores smooth. Cystidia hyaline if present. Taste and odor of radishes.

P. fulvo-squamosa, P. Schraderi.

In general these two species are somewhat similar but neither is well known.

Unattached species of the Truncigeni.—(1) *P. Aegerita.* Close to the *Mutabilis* group in some respects but the evidence is not clear. (2) *P. albocrenulata.* Is really the type of a distinct group, with its large ellipsoid spores 11–15 μ long. (3) *P. destruens* is a well-marked type which should be set off by itself or with *P. comosa* and *P. heteroclita* if either of these should be held distinct.

SECTION III. MUSCIGENI

14. The Mycenoides Group.—Very small plants among *Polytrichum* or *Sphagnum* mosses.

P. mycenoides, P. minima.

There can really be no relationship between the two species included here. The former has smooth truncate spores 9–11 μ long, and the latter has spores not truncate, rough-walled, and 6–8.5 μ long. The relationships of the former may be with the *Togularis* group.

As to the inter-relations of these groups little that is definite can be hazarded. In some respects the *Caperata* group might be considered as the more advanced of the *Humigeni*. This argument would utilize the fact that in *P. caperata* at least there is present a more or less definite universal veil that leaves at times a second annulus-like structure comparable to an imperfect volva, at its base. For that reason the species is sometimes separated off in the genus *Rozites*. The spores are rough-walled, which, other things being equal, must probably be considered an advanced character. Yet otherwise the organization of the hymenium is not so complex as in many other species. Yet each of these groups in the *Humigeni* presents at least one such mark of advancement, assuming that the more complex structures indicate advance in proportion.

In the *Truncigeni*, the *Marginata* group represents probably the most advanced condition in one line of development, but is probably exceeded in another line by the *Adiposa* group, in some species of which one finds the most highly organized sporophores in the genus. The development of cystidia, the high degree of coloration, and the presence of an internal medulla in the trama of the gills (figs. 142, 137, 131, 129, etc.) are marks of advance over plants with the opposite of these characters.

That either these sections or phylogenetic units can be considered as genera is unthinkable. The practice of breaking up the large genera of the fungi does not commend itself, in general, as the proper plan of procedure. In a considerable part of such work that has appeared the limits of genera encroach too closely on those of species. There is still room and use in the taxonomic literature for such a group as the *Sub-Genus* or the *Section*, and the confusion that results in attempting to fit new generic names to old ideas that are well established is lamentable.

VII. ACKNOWLEDGMENTS

In the preparation of this paper I have had access to a considerable series of European specimens from Romell and from Bresadola and have studied our plants with reference to them. As a result, some of my conclusions as to the identity of our species are at variance with those of my predecessors. The majority of the specimens with which I have worked are preserved in five different herbaria: that of the New York Botanical Garden, which contains by far the most extensive collection; Peck's herbarium at Albany, in the New York State Museum; the herbarium of the Missouri Botanical Garden at St. Louis; the herbarium of the Pennsylvania State College at State College, Pa.; and in my own herbarium. My identifications are on the specimens in all of these places, so that I have not felt it necessary to present here all of the data required to identify the particular collections. Consequently, my citation of specimens is limited to data that concerns only the stations involved, from which the geographical range may be obtained at a glance.

Acknowledgments for assistance are gladly given to Dr. W. A. Murrill and the New York Botanical Garden for free access to all collections of the genus at that institution; to Dr. H. D. House for the privilege of studying the many collections in the New York State Museum at Albany; to the Missouri Botanical Garden for access to the herbarium there; to the officials of the Pennsylvania State College for their interest and indulgence in the work; to Dr. R. A. Harper and the Wisconsin Academy of Sciences, Arts, and Letters for permission to reproduce some of the plates published by the late E. T. Harper; likewise to Mr. L. W. Brownell of Paterson, N. J., for original photos presented in plates 16, 17, 20, 21, and 24; to Mr. Burtt Leeper, Salem, Ohio, for plate 18; to Mr. W. S. Odell for plate 12 (photo by Drayton); to Dr. E. T. Harper for the photo in plate 11, sent to me a short time prior to his death; to Mrs. Edna G. Stamy Fox for the final touches that have contributed so much to the appearance of the text figures; and to many others who have contributed specimens or in other ways have aided in the prosecution of the work.

VIII. Taxonomic Considerations

PHOLIOTA

Pholiota Fries, Syst. Myc. 1: 240. 1821.

Plants fleshy, putrescent, solitary to cespitose, geophilous or xylophilous; pileus glabrous to floccose, fibrillose, or distinctly scaly; lamellae adnexed to slightly decurrent; stem central, fleshy, glabrous to fibrillose or scaly, continuous with the flesh of the pileus; veil present, usually membranous, sometimes fibrillose, forming a distinct, though often evanescent, annulus; spores ochraceous-brown to ferruginous or fuscous, smooth or rough; cystidia often present.

Type species: *Pholiota dura* (Bolt.) Fries.

The plants in this genus are analogous to those in *Armillaria* of the white-spored series and in *Stropharia* of the purple-brown-spored series. At some points the genus grades into *Flammula*, due to the early disappearance of the partial veil or the annulus, and in *Flammula* the veil fragments may at times persist as an incomplete annulus.

Key to the Species[1]

1. Plants at maturity not more than 4 cm. broad.....2
   Plants at maturity 4–15 cm. or more broad.....29
2. Plants growing on the ground or among mosses.....3
   Plants growing on stumps, trunks, or rotting logs.....14
3. Pileus distinctly fibrillose or squamulose, especially at the center.....4
   Pileus entirely glabrous at the center, the margin occasionally with white fibers from the veil.....5
4. Stem distinctly scaly below the sheathing veil remnants; gills bright cinnamon in dried plants; known only from Oregon; spores smooth, 5.5–6.5 × 3.5–4.5 μ.....*20. P. terrestris*
   Stem not scaly, somewhat fibrillose; gills deep brown in dried plants; known only from Colorado; spores rough-walled, 7–9 × 5–6 μ.
   .....*19. P. trachyspora*
5. Plants growing among *Polytrichum* mosses.....*18. P. minima*
   Plants growing in wet places among *Sphagnum* mosses.....*9. P. mycenoides*
   Plants growing on the ground or on leaf mold.....6
6. Pileus slimy-viscid; stem heavily white-floccose below the annulus; known only from Washington and Oregon.....*22. P. albivelata*
   Pileus and stem not as above.....7

[1] For a supplementary key to the species see p. 169. It should also be noted that the phylogenetic arrangement on p. 95 can be used as a key to small groups of species, and that the synoptical key in the text, beginning on p. 104, can be used to the same end.

7. Cystidia present and projecting conspicuously from the sides of the gills (figs. 40, 48) 8
   Cystidia absent 11
8. Cystidia 15–20 μ in diameter at the broadest part; spores truncate at one end, 8–10.5 μ long 9
   Cystidia 7–12 μ in diameter at the broadest part; spores not at all truncate, 10–15 μ long 10
9. Spores 4.5–6 μ broad ..... *2. P. praecox*
   Spores 6–7 μ broad ..... *5. P. temnophylla*
10. Plants small, less than 2 cm. in diameter, uniformly fuscous in color; known only from Washington ..... *13. P. subnigra*
    Plants somewhat larger; lighter in color than the above; spores 10–12 μ long ..... *11. P. platyphylla*
    Plants as in the last but spores up to 15 μ long ..... *12. P. erebia*
11. Stem 1–2.5 cm. long; pileus yellowish-red or dark ferruginous and not changing on drying ..... *8. P. rugosa*
    Stem 2–10 cm. long; pileus watery-brown, drying to ochraceous 12
12. Stem filiform, about 1 mm. thick; pileus not more than 2 cm. broad. ..... *10. P. filaris*
    Stem not filiform, 2 mm. or more thick; pileus at maturity more than 2 cm. broad 13
13. Spores 6.5–9 μ long ..... *6. P. blattaria*
    Spores 9–10.5 μ long ..... *7. P. togularis*
14. Pileus entirely glabrous and hygrophanous,[1] the margin usually striatulate when moist (pl. 15) 15
    Pileus scaly[2] or densely fibrillose from the first or becoming so in mature plants; hygrophanous only in *P. confragosa*, but often viscid 20
15. Stem distinctly scaly; gills not forked ..... *30. P. mutabilis*
    Stem not at all scaly; gills forked ..... *28. P. furcata*
    Stem not scaly; gills not forked 16
16. Pileus viscid when fresh ..... *27. P. discolor*
    Pileus not viscid 17
17. Stem hollow, with irregular transverse partitions; known only from California; on small twigs ..... *21. P. anomala*
    Stem stuffed or hollow, not internally partitioned; on logs or on sawdust 18
18. Cystidia absent; spores entirely smooth, slightly truncate at one end (fig. 95) ..... *29. P. marginella*
    Cystidia present, flask-shaped, projecting (fig. 83); spores not truncate, smooth at first, usually somewhat roughened when mature 19
19. Annulus funnel-shaped, persistent, conspicuous; pileus never more than 2 cm. broad ..... *26. P. unicolor*
    Annulus not funnel-shaped, sometimes persistent as a ring but often evanescent; pileus often 3–4 cm. or more broad ..... *25. P. marginata*
20. Pileus dull cinnamon, dull tawny, or brown 21
    Pileus bright-colored, i.e., pinkish-red, yellow, ochraceous-orange, or bright tawny in fresh plants 22

[1] i. e. watery-brown when moist, ochraceous as the pileus begins to lose moisture.

[2] Sometimes young specimens are only fibrillose, the scales appearing as the plant matures; sometimes the young plants are conspicuously scaly, the scales gelatinifying with age and often disappearing.

21. Pileus densely floccose-fibrillose or floccose-squamulose as seen under a lens ..... *47. P. confragosa*
    Pileus densely covered with small erect spine-like scales ..... *48. P. erinaceella*
22. Spores 3–5.5 μ long; dried plants with a yellow pulverulent appearance. ..... *38. P. flammans*
    Spores 6 μ or more long; pileus not pulverulent 23
23. Pileus viscid when fresh 24
    Pileus dry when fresh 26
24. Pileus lemon-yellow or bright sulphur-yellow 25
    Pileus with greenish or purplish tinges and not uniformly nor brightly yellow ..... *Flammula polychroa*[1]
25. Stem concentrically ringed or peronate with white fibrils ..... *50. P. lucifera*
    Stem not peronate, but with scattered recurved yellow scales ..... *51. P. limonella*
26. Gills bright-colored, i.e., ochraceous-orange, bright ferruginous, or ochraceous-buff, and remaining so in dried plants 27
    Gills not bright-colored, rather cinnamon or brown 28
27. Young plants bright-colored and only silky, becoming scaly and tawny when mature; taste mild; spores smooth ..... *53. P. curvipes*
    Young plants dark red and plush-like, becoming somewhat areolate and pinkish-red when mature; taste bitter; spores minutely roughened (fig. 107) ..... *35. P. luteofolia*
28. Pileus drying brown or cinnamon-brown, densely covered with tawny fibrils or tufted and sub-erect scales (pl. 14, fig. 3); stem not bulbous ..... *49. P. muricata*
    Pileus drying ochraceous-tawny with dark innate squamules; stem with a distinct bulb just at base (pl. 14, fig. 4) ..... *52. P. tuberculosa*
29. Plants growing on the ground and not around old stumps and logs or from buried wood 30
    Plants growing on wood, on sawdust piles, or around old stumps or rotting logs, sometimes from buried wood 42
30. Pileus entirely glabrous or at most only with marginal fibers from the veil 31
    Pileus fibrillose, floccose, squamulose, or scaly, at least over the center 37
31. Spores more than 10 μ long 32
    Spores averaging less than 10 μ long 34
32. Cystidia pyriform to subglobose (figs. 1, 3, 5), not projecting conspicuously, about 20 μ in diameter; spores ovoid with a truncate apex (fig. 2) ..... *1. P. vermiflua*
    Cystidia elongated, projecting prominently (20–40 μ) (fig. 43), 5–7 μ in diameter; spores elongate-elliptic, not truncate 33
33. Pileus 2–5 cm. broad; gills 2–4 mm. broad ..... *12. P. erebia*
    Pileus 4–10 cm. broad; gills 4–6 mm. broad ..... *14. P. ombrophila*
34. Plants western; pileus slimy-viscid; stem conspicuously white-tomentose just below the annulus ..... *22. P. albivelata*
    Plants eastern; pileus dry or very slightly viscid in very wet weather; stem not white-tomentose 35
35. Spores 4–6 μ long; annulus membranous, evanescent ..... *23. P. duroides*

[1] This species is so frequently met and at times presents a fairly well-formed annulus, so I have thought it best to include it in the key at this point. No description is given in the text.

Spores 5–8.5 μ long; annulus not membranous but forming a cottony roll on the stem ..... *24. P. Johnsoniana*
Spores 8–10.5 μ long 36

36. Plants growing on the ground in cultivated fields or grassy places, or in open grassy woods, or among straw or other waste vegetable matter carried into the woods; pileus not rugose ..... *2. P. praecox*
Plants growing on the ground in dense woods; pileus not rugose ..... *4. P. Howeana*
Plants growing on very rich humus around rotting logs; pileus rugose at times ..... *3. P. Acericola*

37. Spores 12–17 μ long, decidedly rough-walled (fig. 58) 38
Spores 9–12 μ long, smooth or nearly so ..... *15. P. aurea*
Spores 6–9 μ long, decidedly rough-walled (fig. 64) ..... *19. P. trachyspora*
Spores 6–9 μ long, entirely smooth 39
Spores 4–6 μ long, smooth ..... *23. P. duroides*

38. Pileus dry or moist, in youth showing fine whitish fibrils under a lens; plants eastern ..... *16. P. caperata*
Pileus slimy-viscid, glabrous; plants western ..... *17. P. Mcmurphyi*

39. Pileus very slightly squamulose only at the center ..... *24. P. Johnsoniana*
Pileus uniformly squamulose or nearly so 40

40. Cystidia present, rather abundant, hyaline, fusoid, projecting rather prominently (fig. 149a) ..... *46. P. Schraderi*
Cystidia absent or represented by small inconspicuous brown bodies in the hymenium 41

41. Scales of the pileus rather large, scattered; pileus yellow or buff in color ..... *45. P. rigidipes*
Scales of the pileus minute and dot-like (pl. 23), abundant; pileus brown or pinkish-cinnamon ..... *54. P. angustipes*

42. Pileus glabrous or essentially so at all stages 43
Pileus more or less distinctly fibrillose or scaly 48

43. Pileus watery-brown, cinnamon, yellowish, or pale tan, or drying somewhat brighter, hygrophanous; cystidia present, sometimes quite rare 44
Pileus with more red in its coloration, ochraceous-buff to reddish-yellow or tawny, concolorous or darker in dried plants; not hygrophanous; cystidia none 46

44. Spores truncate at one end (figs. 10, 14), smooth; cystidia 15–20 μ in diameter in the broadest part, not with an elongate tip (figs. 9, 11) ..... *3. P. Acericola*
Spores not truncate, smooth; cystidia 6–10 μ in diameter in the broadest part, not with an elongate tip (fig. 98) ..... *31. P. Aegerita*
Spores not truncate, rough-walled at least at maturity; cystidia 10–15 μ in diameter in the broadest part, with an elongate tip (figs. 83, 89) 45

45. Pileus viscid ..... *27. P. discolor*
Pileus dry or moist ..... *25. P. marginata*

46. Stem 3–6 cm. long ..... *34. P. rubecula*
Stem 6–15 cm. long 47

47. Spores rough-walled (fig. 103); gills not interveined; plants known only from the eastern states ..... *33. P. cerasina*
Spores smooth; gills strongly interveined; plants known only from Oregon ..... *32. P. oregonense*

48. Spores averaging 4–6 μ long 49
Spores averaging 6–11 μ long 50
Spores averaging 11–14 μ long . . . . . *39. P. albocrenulata*
49. Pileus lemon-yellow, zinc-orange, or tawny, with concolorous floccose-fibrillose, sub-appressed scales; stem 2–5 mm. thick . . . . . *38. P. flammans*
Pileus pale cinnamon or cinnamon-buff, with concolorous erect-pointed scales (pl. 22); stem 5–12 mm. thick . . . . . *43. P. squarrosoides*
50. Gills bright-colored, i.e., yellow, bright ferruginous, or ochraceous-orange, and remaining so in dried plants 51
Gills cinnamon to dark ferruginous, tawny, or brown 53
51. Pileus with greenish tints and strongly areolate from an early stage (pl. 18); spores slightly roughened (fig. 113) . . . . . *37. P. aeruginosa*
Pileus pale pinkish-red, frequently slightly areolate at the center; spores slightly rough (fig. 105) . . . . . *35. P. luteofolia*
Pileus apricot-yellow to zinc-orange or tawny, not at all areolate 52
52. Spores rough (fig. 109); pileus 4–15 cm. broad; stem 0.5–3 cm. thick . . . . . *36. P. spectabilis*
Spores smooth; pileus 2–5 cm. broad; stem 2–5 mm. thick . . . . . *53. P. curvipes*
53. Plants with *one* of the following characteristics:
(a) Spores decidedly rough-walled (fig. 109) . . . . . *36 P. spectabilis*
(b) Pileus uniformly covered with minute dot-like scales (pl. 23) scarcely visible except under a lens . . . . . *54. P. angustipes*
(c) Pileus with large white floccose patches or soft white scales . . . . . *56. P. destruens*
Plants with none of the above characters 54
54. Pileus dry 55
Pileus viscid or slimy-viscid 58
55. Cystidia entirely lacking 56
Cystidia at least in part as brown organs among the basidia 57
Cystidia altogether hyaline, projecting prominently (fig. 149a) . . *46. P. Schraderi*
56. Pileus 2–6 cm. broad, with small scales; stem 1.5–3 cm. long, 1–5 mm. thick . . . . . *52. P. tuberculosa*
Pileus 6–12 cm. broad, with a conspicuous fibrous-scaly covering (pl. 13); stem 5–8 cm. long, 8–10 mm. thick . . . . . *55. P. fulvo-squamosa*
57. Pileus with many large recurved, often floccose scales (pl. 21); veil forming a thick persistent floccose annulus; stem conspicuously scaly . . *44. P. squarrosa*
Pileus with scattered appressed inconspicuous scales; veil forming a slight often evanescent annulus; stem only slightly scaly . . . . . *45. P. rigidipes*
58. Cystidia none; plants less than 5 cm. broad at maturity 59
Cystidia abundant, hyaline, flask-shaped, projecting; pileus 2–7 cm. broad . . . . . *Flammula polychroa*[1]
Cystidia as brown organs between the basidia (fig. 127a, 135a); mature pileus 5–15 cm. or more in diameter 60
59. Stem marked with rings of white fibrils; spores 7–9 μ long . . . . . *50. P. lucifera*
Stem not so marked; spores 6.5–7.5 μ long . . . . . *51. P. limonella*
60. Spores 9–11 μ long; known only from Colorado, New Mexico and Wyoming . . . . . *40. P. aurivelloides*
Spores mostly 7–9.5 μ long, occasionally slightly longer 61

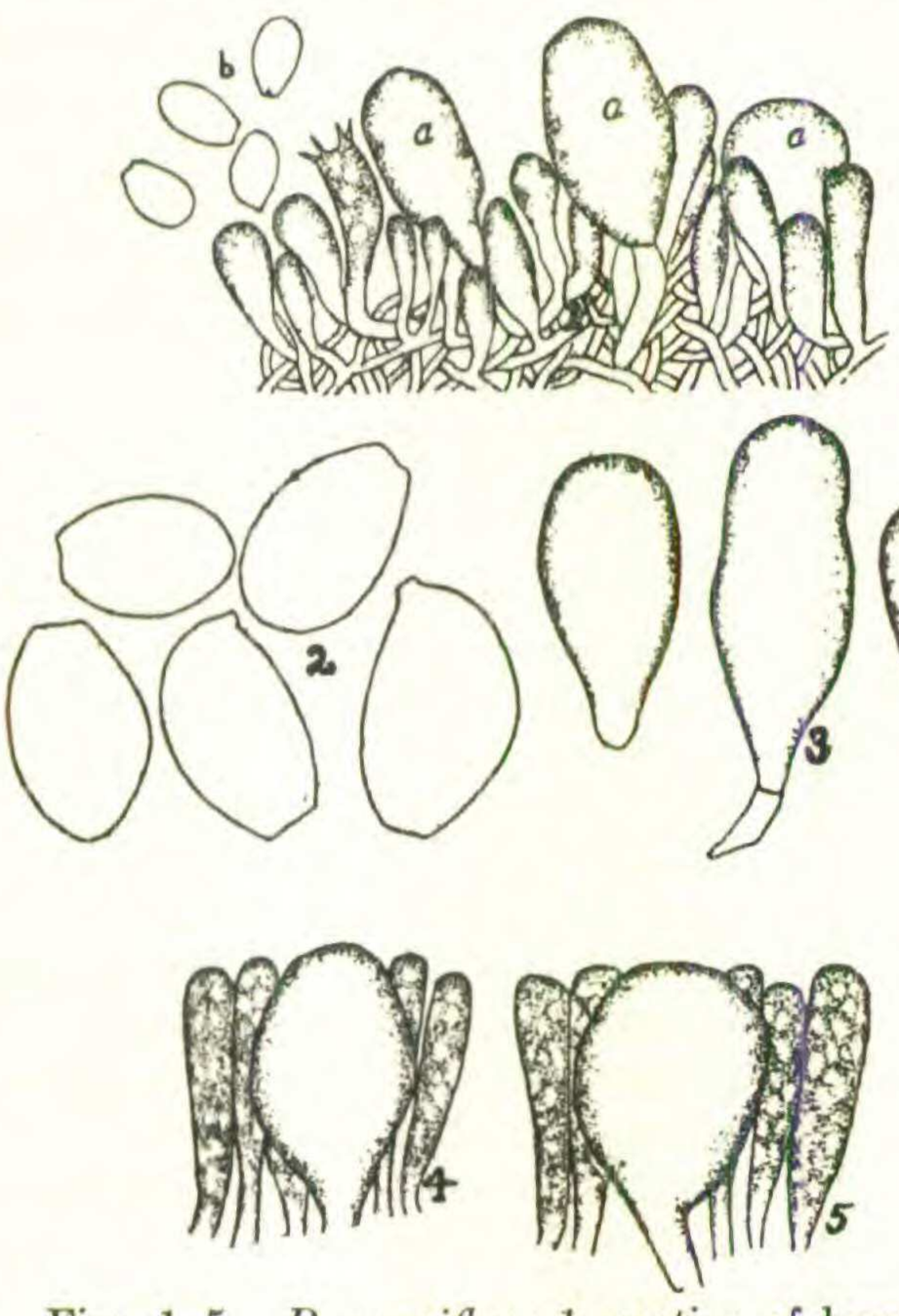
[1] See footnote, bottom p. 101.

61. Pileus with large appressed, spot-like scales; stem increasingly scaly downward; pileus tawny or rusty in color.....*41. P. aurivella*
Pileus with medium-sized scales, often recurved; stem increasingly scaly upward; pileus yellow to zinc-orange.....*42. P. adiposa*

I. *Spores with a truncate apex (fig. 2) (see also II, p. 117).*
A. Cystidia present in the hymenium: largest plants more than 4 cm. broad (see also B, p. 113).
1. Spores 10–14 μ long.

1. Pholiota vermiflua Peck, Rept. N. Y. State Mus. **31:** 34. 1879. Pl. 8.

Pileus 2–12 cm. broad, hemispheric to campanulate or plane, white, cream-color or massicot-yellow, retaining these colors in drying, dry or moist or in wet weather almost viscid, glabrous or the margin fibrillose from the veil, the center often becoming reticulate-areolate at maturity; flesh rather thick, often with a slightly disagreeable taste, pure white; gills slightly uncinate to broadly adnate or sinuate, close, 3–10 mm. broad, white then dark brown, ochraceous-tawny to buckthorn-brown in dried plants; veil white, membranous, forming a superior, often evanescent annulus, or adhering to the margin of the pileus; stem central, equal or more often enlarged at the apex and tapering to a somewhat bulbous base, white or light brown, fibrillose or glabrous, sometimes striate and pruinose at the apex, solid or with a small hollow, 5–12 cm.



Figs. 1–5. *P. vermiflua:* 1, section of hymenium of the type specimens showing the inflated cystidial cells (a) and the spores (b), ×550; 2, spores, ×1200 (note the truncate apex); 3, three isolated cystidia from the type specimens, ×550; 4 and 5, more globose cystidia not projecting, ×550.

long, 3–15 mm. thick; spores ovoid or elliptic, more or less truncate at the apex, smooth, 10–14 × 6–8 μ; cystidia present, subglobose to pyriform with a tapering base, 35–45 × 20 μ, not prominent, sometimes quite rare.

Habitat: on the ground in cultivated, grassy, or waste places; not in dense woods.

Distribution: specimens have been examined from Cambridge, Mass.; Ticonderoga, Rochester, Menands, Bronx Park, and Scarsdale, N. Y.; State College, Pa.; Chapel Hill, N. C.; West Elkton, Ohio; Greencastle, Ind.; Lexington, Ky.; St. Louis, Mo.; Rooks Co., Kan.; Denver, Colo.; Berkeley and San Francisco, Cal.

Illustration: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 28 C–F, 29;* **18:** *pl. 11–13* (as *P. dura*).

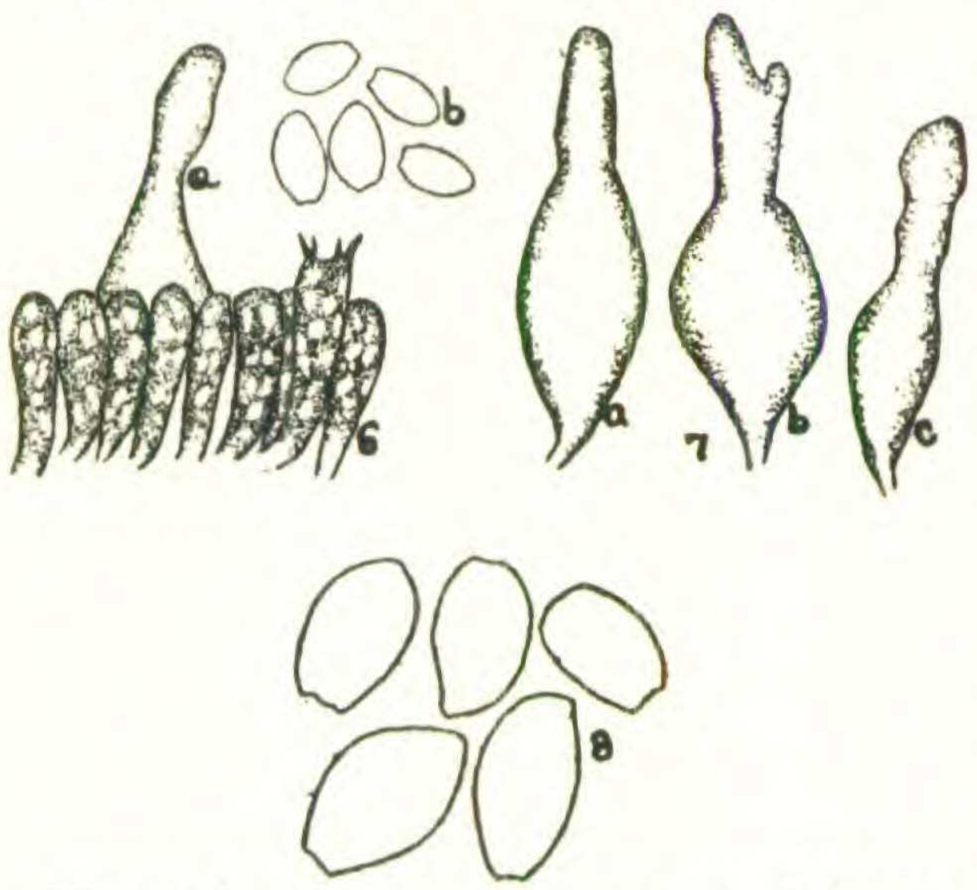
Closely related to *P. praecox* with which it has often been confused. The larger spores will invariably separate it from that species. The thin, slender-stemmed, *Panaeolus*-like form with a rich brown color to the gills grades over gradually into the thick, heavy, fleshy form with areolate pileus. This species is apparently *P. dura* Bolt. of Europe, often reported from this country, but the final evidence that the two are the same is yet lacking. If they are identical then all the earlier descriptions and spore measurements reported for *P. dura* are erroneous, and based on the fleshy forms of *P. praecox*. Bresadola gives the clue to the situation in describing *P. dura xanthophylla*, in which he reports the spores as 10–12 μ long, and indicates that in the true *P. dura* they are the same, although all earlier records report them as approximately 8–10 μ long; Ricken and Lange, in their recent work on the *Agaricaceae*, also give a difference in spore measurements as indicated above. From these facts I conclude that in all probability the plants described here as *P. vermiflua* represent the true *P. dura*, and the species is distinct in the larger spores. In *P. praecox* they rarely reach a length of more than 10 μ.

Hebeloma hortense Burt, recently described from Missouri, probably belongs here as an evelate form. Cooke's illustration of *P. dura* represents that species quite well except for the veil. See further under *P. praecox*.

2. Spores 8–10.5 μ long.

2. Pholiota praecox (Pers.) Fries, Syst. Myc. **1**: 282. 1821.
Agaricus praecox Pers. Comm. Fung. Bavar. 89. 1800. Pl. 9.

Pileus 2–14 cm. broad, convex to campanulate or nearly plane, sometimes umbonate, often fuscous or fuscous-black when very young, soon whitish or cream-color, often tinged with yellow or tan, or the center brownish, or in wet weather uniformly tan, usually ochraceous or tan in herbarium specimens, hygrophanous in wet weather, soft, glabrous, or at times as though finely tomentose, dry or moist, areolate in dry weather or in large specimens; flesh white, odor and taste strongly farinaceous; gills sinuate-adnate to broadly adnate or with a very slight decurrent tooth, medium-close, whitish, becoming brown or rusty-brown, honey-yellow to clay-color or snuff-brown in herbarium specimens, 3–12 mm. broad; veil membranous, forming a white, superior, persistent or evanescent annulus, or partially adhering to the margin of the pileus; stem central, equal or somewhat bulbous below, whitish, pruinose-mealy to slightly fibrillose, squamose, furfuraceous, or becoming nearly glabrous, often striate above the annulus, stuffed or hollow, 3–15 cm. long, 3–20 mm. thick; spores ovoid, usually with a truncate apex, smooth, deep brown, 8.5–10 × 4.5–6 μ; cystidia present, flask-shaped or ventricose, sometimes rare, projecting somewhat, 14–18 μ in diameter.



Figs. 6–8. *P. praecox:* 6, section of the hymenium showing a cystidium (a) and the spores (b), × 550; 7, three types of cystidia isolated from the hymenium, × 550; 8, spores, × 1200. All from Overholts Herb. 3318.

Habitat: on grassy ground, in lawns, fields, etc.; sometimes on the ground in open woods, or on straw or other litter carried into woods.

Distribution: specimens have been examined from Boston, Mass.; Washington, D. C.; Bronx Park, Whitestone, Lake Placid, and Syracuse, N. Y.; Philadelphia Co., and State College, Pa.;

West Elkton, Ohio; Tolland, Lake Eldora, and South Boulder Cañon, Colo.; Berkeley, Santa Barbara, and Del Monte, Cal.; Corvallis, Ore.; Seattle, Wash.; Banff, Alberta, Canada; Yakutak Bay, Aqua Dulce River, and Muir Glacier, Alaska. Also reported from Illinois by Harper, and from Michigan by Kauffman.

Illustrations: Atkinson, Mushrooms, *pl. 42;* ed. 2, *pl. 46;* Berkeley, Outl. Brit. Fung., *pl. 8, f. 1;* Bresadola, Fung. Mang. *pl. 49;* Cooke, Ill. Brit. Fung. *pl.* (*360*) *381;* Gillet, Champ. Fr. *pl.* (*292*) *524;* Hard, Mushrooms, *f. 209;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 27, 28 A, B;* Kauffman, Agar. Mich. *pl. 59;* Murrill, Mycologia **3:** *pl. 49, f. 1;* Patouillard, Tab. Anal. Fung. *f. 112;* Peck, Rept. N. Y. State Bot. **49:** *pl. 46;* Peck, N. Y. State Mus. Mem. **3:** *pl. 57.*

This is undoubtedly our most common *Pholiota* and undoubtedly grows in every state in the Union. I find it to be abundant in May and June in Pennsylvania, and it was just as common in Colorado in June and July at elevations ranging up to nearly 10,000 feet. The annulus formed is usually ample and membranous, but rather fragile, and apt to disappear early, or may all but fail to develop, and may hang to the margin of the pileus instead. Most writers have remarked of the close relationship of this species to *P. dura*, a species that does not occur in America unless represented by *P. vermiflua* (which see). The spores are distinctly smaller than in that species, however. Kauffman's record (9–13 × 6–7 μ) probably includes spores from both species, while Harper's record of *P. dura* is undoubtedly this species.

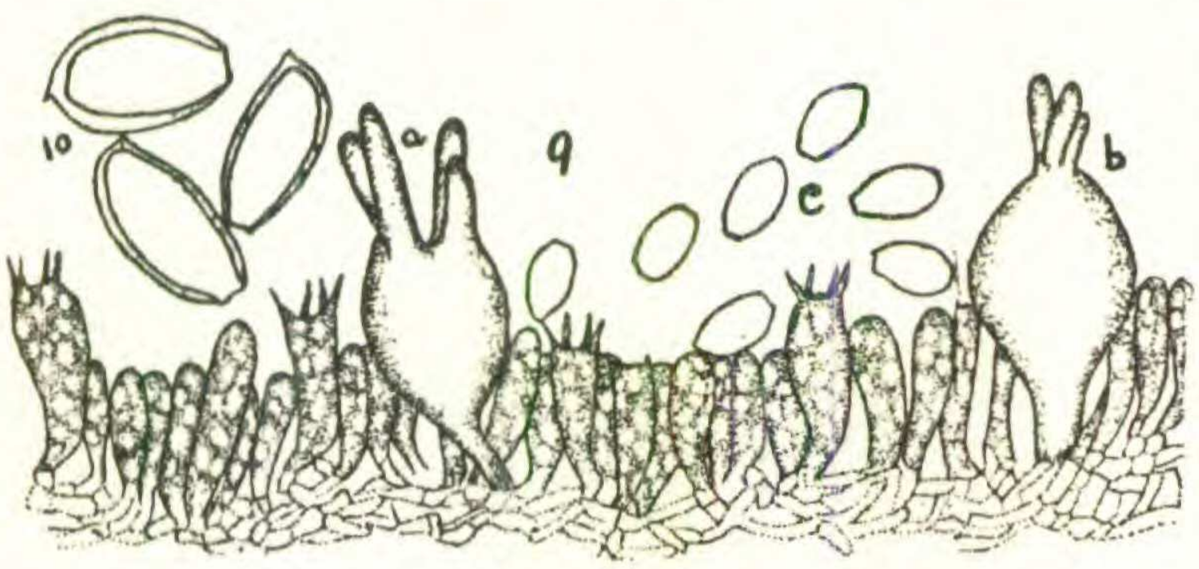
At different times reports have reached the writer of the existence of an evelate and exannulate form of this species or of *P. dura.* These are the plants recently described by Dr. Burt from St. Louis, Mo., as *Hebeloma hortense* n. sp. The writer collected this plant in abundance in the Missouri Botanical Garden as early as April, 1914. No sign of a veil is to be found and the plant has much of the characteristic habit of the short-stemmed form of *P. praecox* or of *P. vermiflua.* The pileus may become considerably areolate in dry weather or with age, and the spores give the larger measurements of those of *P. vermiflua*, and have the same characteristic ovoid shape with a truncate apex. Cystidia similar to those in *P. vermiflua* have been noted in sec-

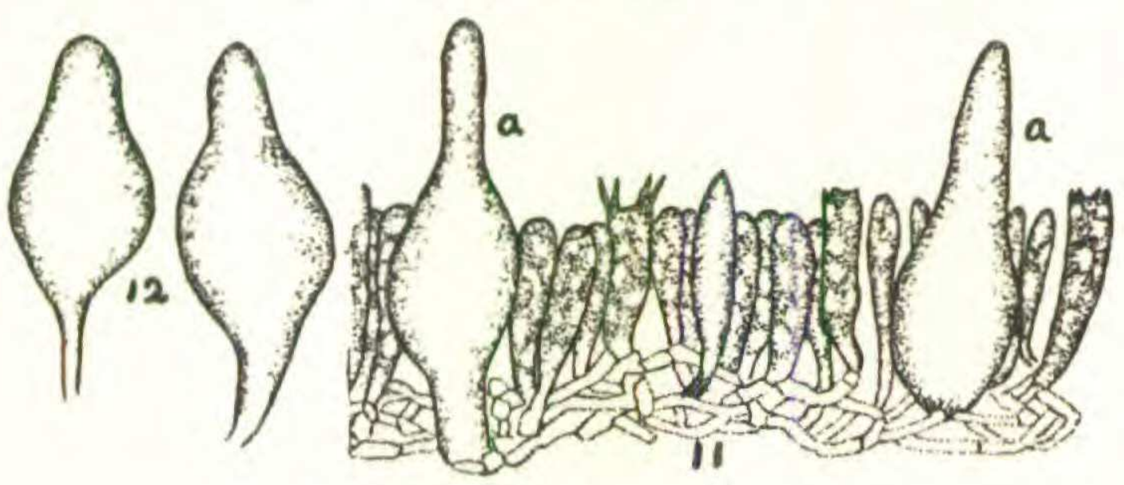
tions of these plants. It seems quite likely that *Hebeloma hortense* is a recent variation from *P. vermiflua* (= *P. dura*), and our imperfect system of Agaric classification necessitates its reference to the former genus.

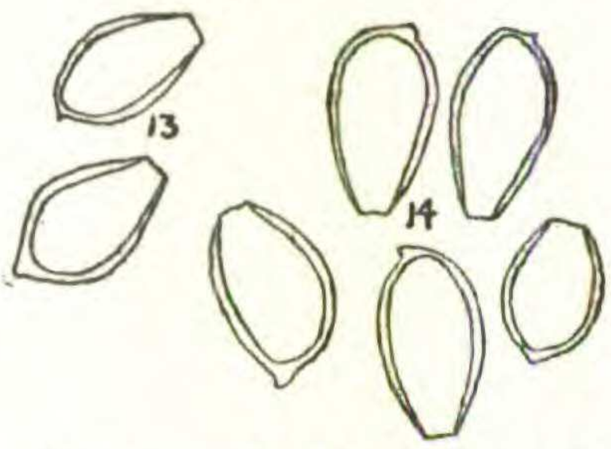
A sterile form of *P. praecox* is described by Murrill from the vicinity of New York City.

3. Pholiota Acericola Peck, Bul. Buffalo Soc. Nat. Sci. **1**: 50. 1873. Pl. 10.

Pileus 2.5–7.5 cm. broad, broadly convex or nearly plane, rarely somewhat umbonate, cream-buff to clay-color or buckthorn-brown when young and moist, buff-yellow or Naples-yellow when old, the center frequently somewhat darker than the margin, not strongly hygrophanous but changing color from young to old condition, glabrous, clay-color to tawny in herbarium specimens, often rugosely reticulated or corrugated; margin even, sometimes upturned; flesh thin, white, taste and odor farinaceous; gills sinuate-adnate or with a small decurrent tooth, medium-close, 2.5–7 mm. broad, grayish,







Figs. 9–14. *P. Acericola:* 9, section of the hymenium, showing the peculiar three- or four-pointed cystidia (a and b), and the spores (c), × 550; 10, spores, × 1200 (Overholts Herb. 3986); 11, section of the hymenium showing flask-shaped cystidia (a) (Overholts Herb. 984); 12, isolated cystidia, × 550 (Overholts Herb. 3953); 13, spores, × 1200 (Overholts Herb. 3765); 14, spores, × 1200 (Overholts Herb. 3911).

becoming brownish-ferruginous or at some stages with a purplish cast, the edge floccose-crenulate; veil forming a large, persistent, or rarely evanescent, membranous, superior or in some instances nearly median, deflexed, white annulus, sometimes of a rich brown color and striate on the upper side; stem central, equal or thickened at the base, fibrillose-striate to nearly glabrous, white or whitish, stuffed or hollow, typically with more or less of a white tomentum and strings of mycelium at the base, 6–11 cm. long, 4–15 mm. thick; spores ovoid or ovoid-elliptic, with a truncate apex, smooth, dull brown, 8.5–10.5 × 5–6 μ; cystidia present but not abundant, flask-shaped or broadly fusoid but only the tips projecting, rather conspicuous, the tips rarely two- to three-forked, 15–20 μ in diameter below.

Habitat: mossy rotted trunks of deciduous trees, perhaps also on coniferous wood; rarely on the ground around rotting logs or on leaf mold.

Distribution: specimens have been examined from Bar Harbor, Me.; Redding, Conn.; Lake Placid, Arkville, Bronx Park, Sand Lake, Raybrook, Van Cortlandt Park, and East Worchester, N. Y.; Falls Church, Mountain Lake, Crabbottom, and Blacksburg, Va.; Pink Bed Valley, N. C.; Auburn, Ala.; State College and Gray's Run, Lycoming Co., Pa.; Oxford, Ohio; St. Louis, Mo.; Tolland, Colo.; Santa Cruz, Cal.; also reported from Michigan by Kauffman.

This is one of our most common species and as here admitted is found to range from the Atlantic to the Pacific. The distinguishing characters are the ochraceous color, the slender habit, the ample persistent membranous annulus, the truncate spores, and the white mycelial strands at the base of the stem. Peck's original collection was from old maple logs, and I have tried to limit the species to a woody substratum but it is impossible. I would like to separate *P. sphaleromorpha* as a distinct geophilous species as based on European specimens at New York, but it is manifestly impossible, at least with our present knowledge of the plants. Bulliard's original illustration fits our plant remarkably well. Patouillard (Tab. Anal. Fung. *pl. 645*) shows a rosy or purplish tint to the gills of that species very comparable to the color of the gills in our specimens. A collection from Colorado

in my own herbarium (1866) is remarkably similar to authentic European interpretations of *P. sphaleromorpha*, but it grew on a rotten log and can as well be referred to *P. Acericola*, although the spores are a trifle broader and only inconspicuously truncate. Microscopically these plants all agree in their characteristic ovoid spores with truncate apex, and in the cystidia. In some specimens I find cystidia of peculiar shape with two or three or four cylindrical projections at the tips, so that except for the lack of vertical walls in the enlarged base the entire organ is almost an exact picture of the longitudinally septate basidium of a *Tremella* (fig. 9a). This throws an interesting side-light on the origin of cystidia, as these four projections are undoubtedly a prolific development of the usual four sterigmata of the basidium.

Numerous collections were found at New York to be referred to the genus *Stropharia*, as the slight purplish tint of the gills might indicate. The habit, especially where the plants are growing on rich humus, is very much like that of *Agaricus silvicola* or *A. placomyces*. Specimens growing on the ground are likely to be mistaken for *P. praecox* which is not usually a woodland plant. The spores are sometimes slightly wedge-shaped at the base, giving them an appearance of being obscurely 5-angled as reported by Kauffman. Several other species show this same character.

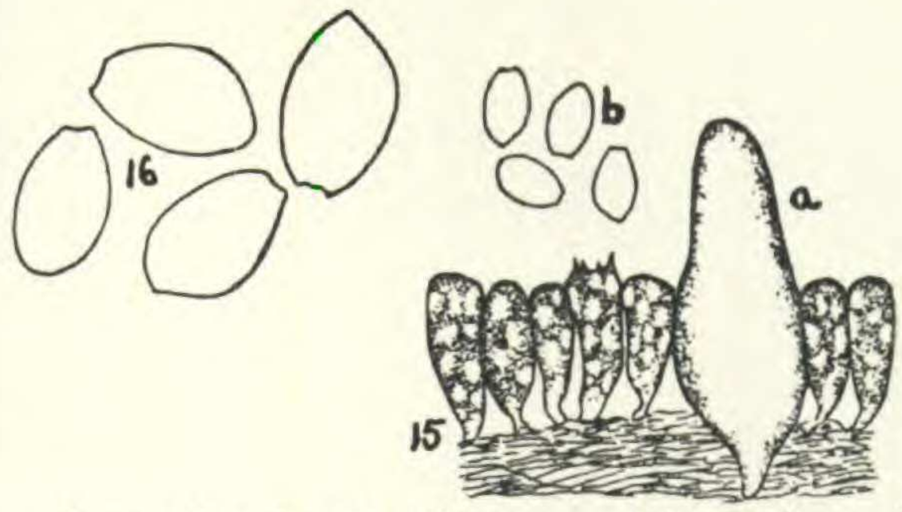
In view of its wide distribution Harper's failure to identify this species as a member of the flora of the Great Lakes Region is somewhat surprising.

4. Pholiota Howeana Peck, Rept. N. Y. State Mus. **26:** 59. 1874.

Stropharia Howeana Peck, Bul. Buffalo Soc. Nat. Sci. **4:** 53. 1873.

Pileus 2.5–8 cm. broad, convex then plane, subumbonate, yellowish or yellowish-brown, sometimes lighter and slightly rugulose when mature, sometimes darker in the center, dry, even, glabrous; margin even; context fragile, fleshy, bitter to the taste; gills sinuate-adnate or with a decurrent tooth when young, often entirely separating and leaving a distinct trace on the stem, whitish, becoming ferruginous-brown, rather close, eroded and lighter-

colored on the edge; veil forming a conspicuous, persistent, superior annulus; stem central, equal or slightly thickened at the base, colored similar to the pileus, glabrous, or the base white-tomentose, hollow, 5–11 cm. long, 4–7 mm. thick, sometimes with white mycelial cords at the base; spores ovoid or ovoid-elliptic, truncate at the apex, smooth, dilute brown, 8–10 × 4.5–5.5 μ; cystidia present but quite rare, broadly flask-shaped, projecting, hyaline.



Figs. 15–16. *P. Howeana:* 15, section of hymenium, showing a cystidium (a), and spores (b), × 550; 16, spores, × 1200. All from type specimens.

Habitat: on the ground in woods and bushy places, often among grass.

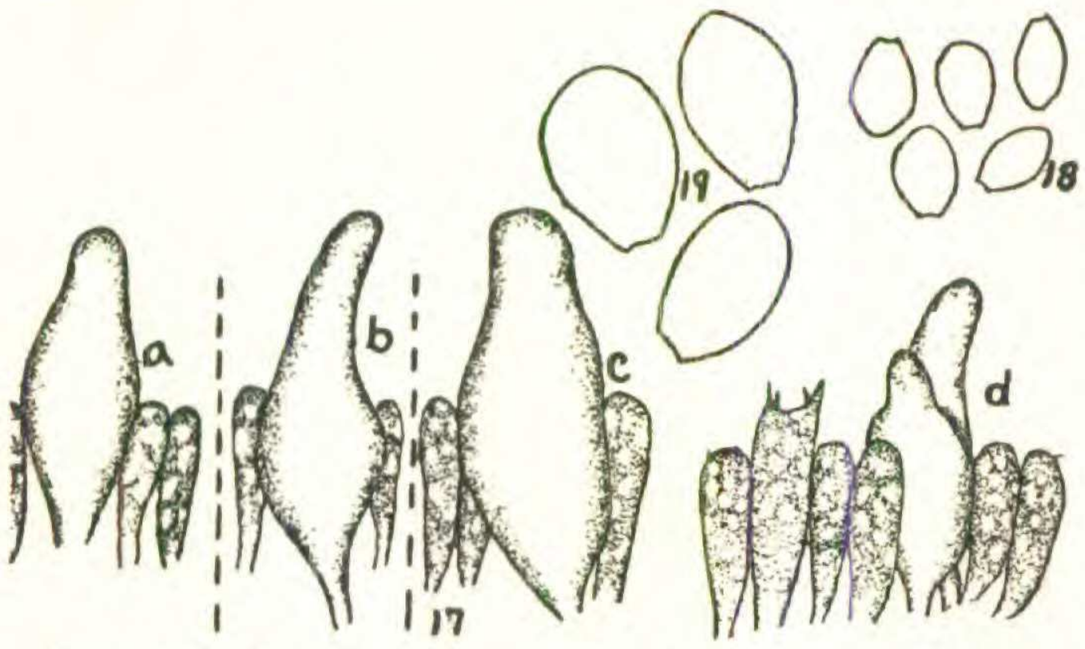
Distribution: reported, in addition to the type locality, Center, N. Y., from Michigan by Kauffman.

I must admit my inability to distinguish this species among the several hundred collections I have examined, in both fresh and dried condition. Harper likens it to *P. sphaleromorpha*, and Patouillard shows that species with a rosy or purplish tint to the gills as would be indicated for Peck's plant by its original inclusion in the genus *Stropharia*. Undoubtedly, if it is a woods form, and I have met with it, I have referred the specimens to the terrestrial form of *P. Acericola*, but unless the color of the gills is well marked I hardly see how the species can be admitted. *P. sphaleromorpha*, as I have remarked in another place, is extremely similar to the terrestrial form of *P. Acericola*. My first sections of the type specimens of *P. Howeana* yielded no cystidia, but I have since found them to be present but quite rare. When present they are very similar to those in *P. Acericola*, but somewhat less narrowed at the neck. Kauffman reports the species as occurring in open grassy fields, while Peck says it occurs in woods and bushy places. The five-angled form of the spores stressed by Kauffman is not more marked in the types of *P. Howeana* than in *P. Acericola*, but the spores may be slightly broader in proportion to their length than in that species. I have so far seen no characteristics that would set it off from

P. praecox if it grows in grassy open places, nor from the terrestrial form of *P. Acericola* if it grows in deep woods.

5. Pholiota temnophylla (Peck) Sacc. Syll. Fung. **5:** 740. 1887.
Agaricus temnophyllus Peck, Rept. N. Y. State Cab. **23:** 90. 1873.

Pileus 2.5–5 cm. broad, hemispheric becoming convex, ochraceous-yellow, cinnamon-buff to ochraceous tawny in dried plants, smooth, glabrous, dry; gills obliquely sinuate-adnate, medium-close, 4–8 mm. broad, brownish-ferruginous; veil membranous, white, forming a distinct, superior, persistent annulus; stem central, equal, white, glabrous, hollow, 5–10 cm. long, 4–8 mm. thick; spores elliptic to ovoid, one end usually slightly truncate, smooth, 9–10.5 × 6–7 μ; cystidia present but rather rare, flask-shaped or fusoid, hyaline, 17–21 μ in diameter, projecting prominently.



Figs. 17–19. *P. temnophylla:* 17, sections taken at different places along hymenium, showing various types of cystidia (a-d), × 550; 18, spores, × 550; 19, spores, × 1200. All from type specimens.

Habitat: grassy ground by roadside.

Distribution: known only from the type locality, Sand Lake, N. Y., except as reported by Harper from Illinois and by Kauffman in Michigan.

Illustration: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 33, A.*

I have been unable to detect this species in my own collecting grounds or in the herbarium material examined. It is evidently too close to *P. praecox* to be recognized from dried plants unless the broader apex of the cystidia will be an aid. I did not locate the cystidia in my first sections of the type material but a later examination showed their presence, but they are not abundant. Harper's specimens were identified by Peck. The obliquely and strongly truncate proximal edge of the gills is stressed as an important character.

B. Cystidia absent from the hymenium; largest plants not more than 4 cm. broad.

1. Spores 6–9 μ long.

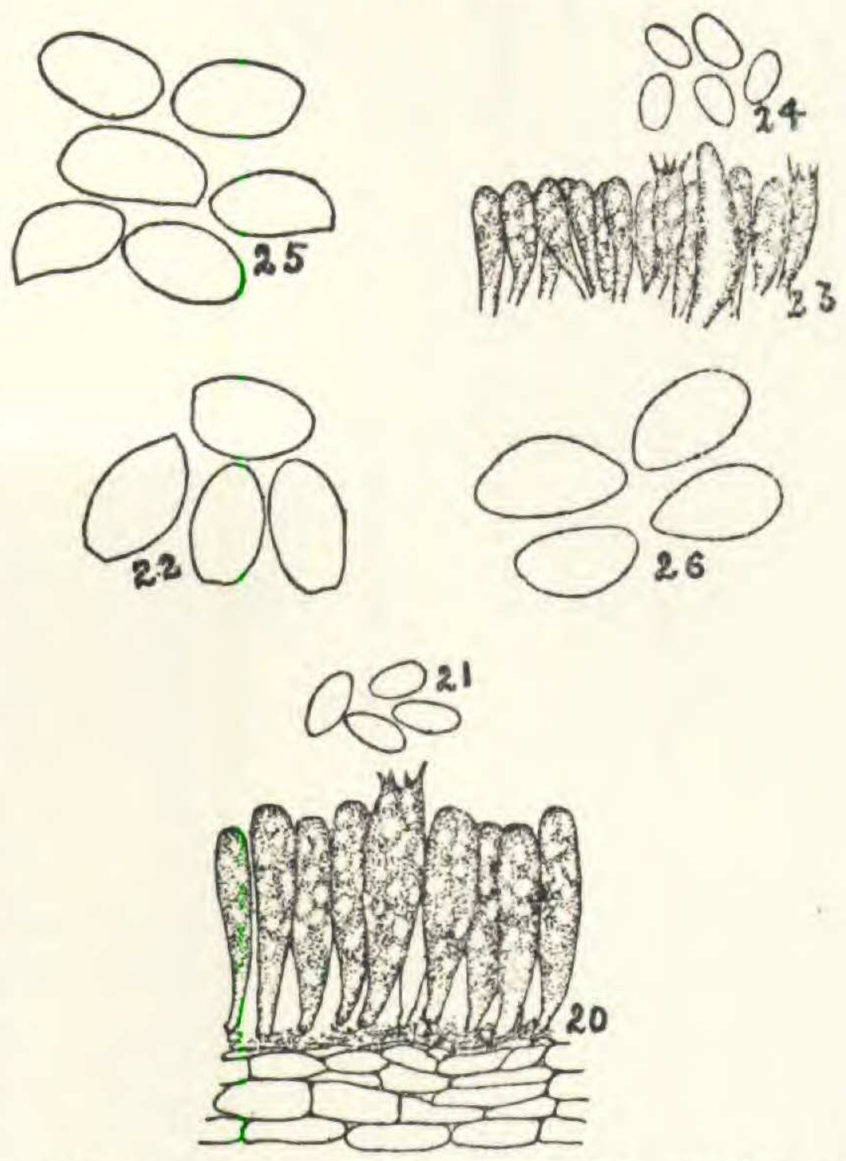
a. On wood.

See II B 1b, Nos. 29 and 30 (P. mutabilis and P. marginella).

b. On the ground.

6. Pholiota blattaria Fries, Syst. Myc. 1: 246. 1821.

Pileus 1–4 cm. broad, convex to plane, obtuse or more often somewhat umbonate, clay-color to ferruginous or hazel, ochraceous or cinnamon-buff on drying, hygrophanous, glabrous, the margin striate or striatulate when moist, often becoming somewhat rugose on parting with the moisture; flesh concolorous, odor none, taste mild; gills rounded behind, soon becoming free, 2–4 mm. broad, close, ventricose, clay-color to cinnamon; veil forming a subpersistent superior or median annulus, often striate on the upper side; stem central, equal or tapering upward, covered with small white fibrils either entirely or only at the base, whitish or slightly brownish, hollow, 2.5–5 cm. long, 2–4 mm. thick; spores ovoid or narrow-ovoid, sometimes with a slightly truncate apex, 6.5–9 × 4–5 μ; cystidia none.



Figs. 20–26. *P. blattaria:* 20, section of hymenium showing basidia, × 550; 21, spores, × 550; 22, spores, × 1200 (from specimens at New York, collected on Long Island by Dodge and Seaver); 23, section of hymenium of No. 967, × 550; 24, spores of same, × 550; 25–26, various types of spores from same collection, ×550.

Habitat: on the ground in wooded or grassy places.

Distribution: specimens have been examined from Long Island, N. Y.; Oxford, Ohio; and St. Louis and Meramec Highlands, Mo.

Most European writers assign spore measurements of 6–8 μ in length to *P. blattaria,* and Peck's basis for separating *P. rugosa* from this species was on the larger spores that are 8–10 μ long as in *P. togularis* Bull. (non Fries). The only specimens of this

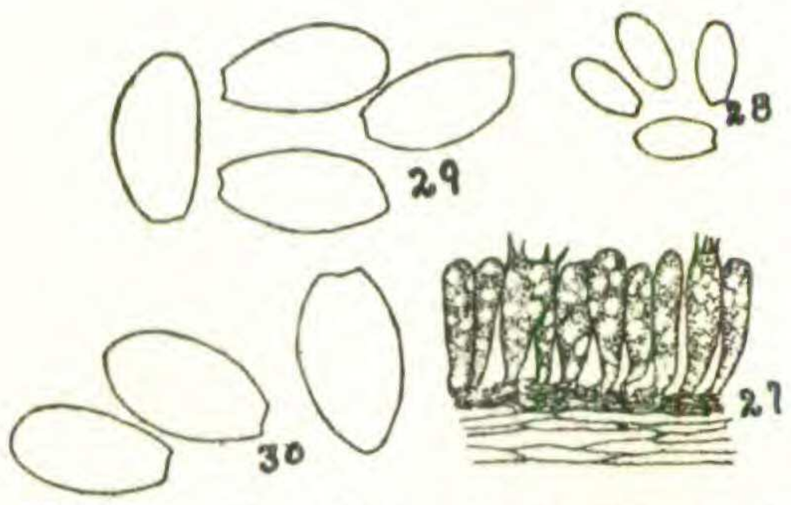
group with the shorter spores that I have seen are those collected on Long Island by Dodge and Seaver, a collection by Trelease and one by myself from Missouri, and one from Ohio.

2. Spores 9–11 μ long.

7. Pholiota togularis (Bull.) Quel. Champ. Jura Vosges, 92. 1872. Pl. 15.

Agaricus togularis Bull. Herb. Fr. *pl. 595, f. 2.* 1793.

Pileus 1–4 cm. broad, campanulate or convex, becoming nearly plane, watery-brown when fresh, hygrophanous, becoming ochraceous on drying, warm-buff or ochraceous-buff in dried specimens, the margin striatulate when moist, glabrous, even or perhaps rugose at times; gills sinuate and narrowly attached, medium-close or subdistant, yellow becoming pale ferruginous, often ochraceous-buff in dried specimens; veil forming a conspicuous, persistent, median annulus, striate on the upper side; stem central, equal, yellow at the top and brownish at the base or entirely brownish, slightly fibrillose, hollow, 2.5–10 cm. long, 2–5 mm. thick; spores narrow-ovoid or ovoid, truncate at the apex, smooth, 9–10.5 × 4–6 μ; cystidia none.



Figs. 27–30. *P. togularis:* 27, section of hymenium showing basidia, × 550; 28, spores, × 550; 29, spores, × 1200. All from collection in New York State Museum, from North Elba, New York. 30, spores, × 1200, from collection at New York from Falls Church, Virginia, by Murrill.

Habitat: on the ground in woods or pastures.

Distribution: specimens have been examined from Falls Church, Va., and Stow, Mass.; also reported by Harper (as *P. blattaria*).

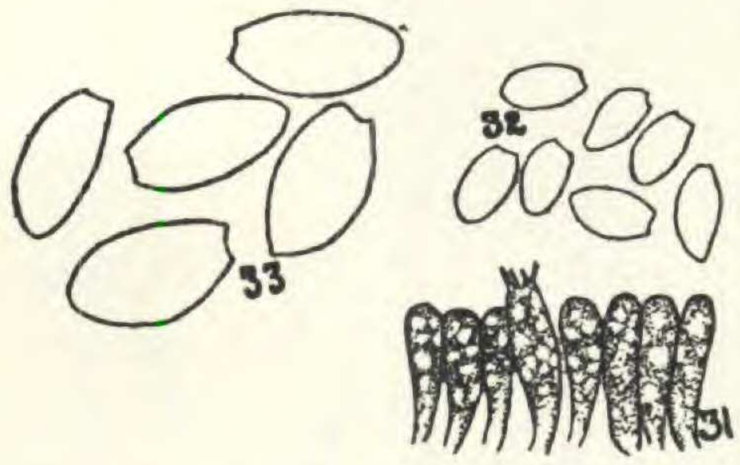
Illustrations: Bulliard, Herb. Fr. *pl. 595, f. 2;* Boudier, Ic. Myc. *pl. 101;* Cooke, Ill. Brit. Fung. *pl. 350 (379);* Gillet, Champ. Fr. *pl. 289 (528);* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 59* (as *P. blattaria*).

This species seems to be well separated from *P. rugosa* by the larger stature throughout and the ochraceous or buff colors on drying. As here described the species is not *P. togularis* of Fries and perhaps Ricken, but compares well with the original il-

lustration of Bulliard. In this sense both Boudier and Patouillard have correctly described our plants, the plate given by the former being particularly good. *P. blattaria* as illustrated by Harper is more typical than any of those mentioned, however.

8. Pholiota rugosa Peck, Rept. N. Y. State Mus. **50:** 102. 1897. Pl. 15.

Pileus 8–25 mm. broad, broadly conic or campanulate to convex or plane, sometimes umbonate, yellowish-red or dark ferruginous, cinnamon or tawny in herbarium specimens, hygrophanous, glabrous, slightly rugose in the center; margin striate, often upturned in age; flesh very thin, concolorous, odor and taste not characteristic; gills at first adnate, becoming adnexed or free with age, medium-close, usually minutely denticulate on the edge, 1–3 mm. broad, yellowish white, becoming ferruginous or brownish-ferruginous, amber-brown in dried plants; veil forming a white, persistent, membranous, median annulus, striate on the upper side; stem central, equal or tapering upward, yellowish above, brownish or blackish-brown below, finely floccose below the annulus, pruinose or mealy above, hollow, 1–2 cm. long, 1.5–4 mm. thick; spores elongate-elliptic, slightly truncate at one end, smooth, 8–11 × 4–5 μ; cystidia none.



Figs. 31–33. *P. rugosa:* 31, section of hymenium showing basidia; 32, spores, × 550; 33, spores, × 1200. All from type specimens.

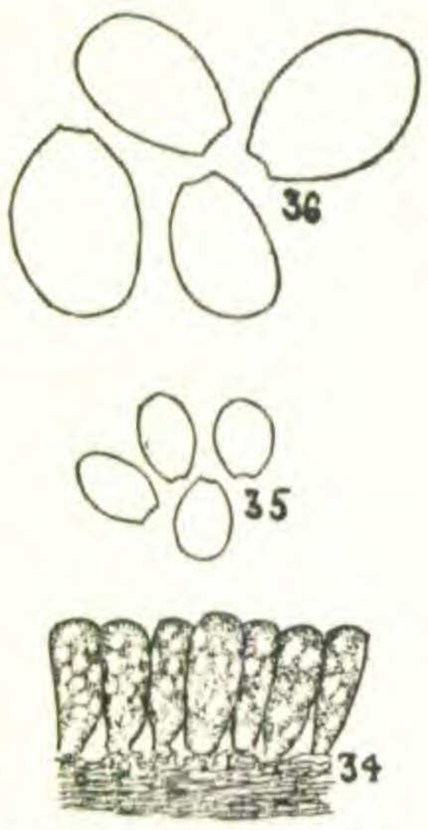
Habitat: on the ground in open woods; also in greenhouses.

Distribution: specimens have been examined from Adirondack Mts. and North Elba, N. Y.; State College, Pa.; also reported by Kauffman from Michigan.

While closely related to *P. togularis* Bull., the stature is smaller and the color is dark reddish-brown or ferruginous and remains so in herbarium specimens. *P. blattaria* is distinct in the smaller spores. I find the plant occurring on the ground in greenhouses.

9. Pholiota mycenoides Fries, Syst. Myc. **1:** 246. 1821.

Pileus 0.5–2 cm. broad, at first convex, at maturity plane, rather thin and membranous, rusty-brown when moist, buck-thorn-brown to ochraceous-tawny in herbarium specimens, hygrophanous, drying first at the center and becoming ochraceous to deep cream-color, glabrous; margin widely striate and sometimes white-fibrillose from the cobwebby veil; flesh concolorous, odor none, taste mild or sub-farinaceous; gills adnate or somewhat sinuate, and becoming nearly free, sometimes uncinate, medium-close or slightly distant, rusty-brown, 2–3 mm. broad; veil forming a conspicuous, nearly median, membranous annulus, often striate on the upper side; stem central, equal or tapering upward, slender, pallid to brown, glabrous or nearly so, hollow, 4–10 cm. long, 1–3 mm. thick; spores ovoid or broadly ovoid. the apex truncate, smooth, 9–11.5 × 6–7.5 μ; cystidia none.



Figs. 34–36. *P. mycenoides:* 34, section of hymenium showing basidia, × 550; 35, spores, × 550; 36, spores, × 1200. All from Overholts Herbarium No. 2380.

Habitat: among mosses, especially *Sphagnum*, in swampy places.

Distribution: specimens have been examined from Stow, Mass.; also listed by Kauffman from Michigan on the basis of Beardslee's report.

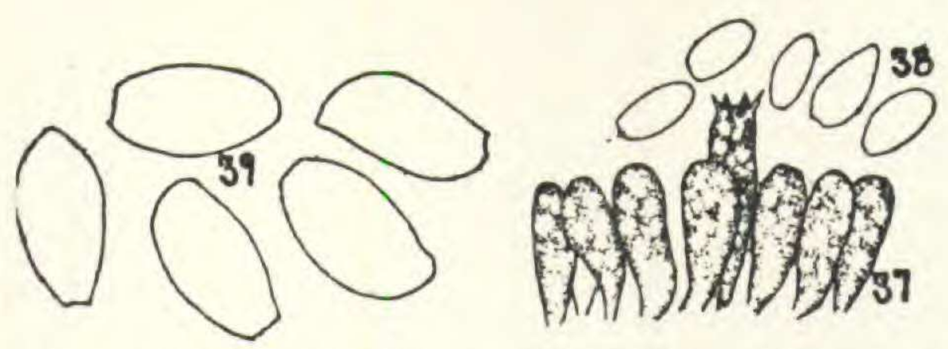
Illustrations: Boudier, Ic. Myc. *pl. 102;* Cooke, Ill. Brit. Fung. *pl. 503 (405) B.*

Apparently a very rare species. The very slender plants, with long stem, narrow pileus, median annulus, and the truncate spores point to a relationship with the *P. togularis* group. The habitat is taken, by European writers, to be a characteristic feature of the species. We have in this country a plant somewhat similar to this species, but with a stem that is distinctly peronate with white fibrils and spores broadly elliptic without sign of truncate apex.

10. Pholiota filaris (Fries) Peck, Bul. N. Y. State Mus. 122: 144. 1908.

Pholiota togularis filaris Fries, Ic. Hym. **2:** 2. 1877.

Pileus 0.5–2 cm. broad, campanulate or convex to plane, ochraceous when fresh, tawny or cinnamon-rufous in dried plants, glabrous, dry; margin striate, the striae visible in dried plants; flesh very thin; gills adnate, medium-close, yellow, becoming pale ferruginous, tawny or cinnamon-rufous in dried plants, 1–2 mm. broad; veil forming a distinct, persistent, median or superior though distant annulus, striate on the upper side; stem central, equal, glabrous or slightly fibrillose, pallid to brown, hollow, 2–5 cm. long, about 1 mm. thick; spores elongate-ellipsoid or elongate elliptic, often inequilateral, truncate at the apex, smooth, brown, 9–10.5 × 4.5–5 μ; cystidia none.



Figs. 37–39. *P. filaris:* 37, section of hymenium showing basidia, × 550; 38, spores, × 550; 39, spores, × 1200. All from collection at New York from Washington, by Murrill.

Habitat: on the ground in woods or pastures.

Distribution: specimens have been examined from Catskill Mts., N. Y.; Washington (state).

There seems to be room for a species in the *P. togularis* group with the following salient features: small size, slender habit, with *thread-like stem*, and large spores 9–10.5 μ long. However, it may intergrade too much into *P. togularis*, though the habit seems distinct enough. I have followed Peck in recognizing the species.

II. Spores not with truncate apex.

A. Growing on the ground or among moss (see also B, p. 132).

1. Plants with large spores 10–15 μ long (see also p. 125).

a. Plants 1–5 cm. broad at maturity (see also p. 120).

11. Pholiota platyphylla Kauffman, Papers Mich. Acad. Sci. **1:** 145. 1921.

"Pileus submembranous, 1–3 (4) cm. broad, convex, obtuse or obsoletely subumbonate, hygrophanous, 'tawny' (Ridg.) disk 'mars brown,' fading to 'antimony-yellow' or 'warm-buff,' obscurely striatulate on margin when moist, glabrous; flesh very thin on the incurved margin, concolor. Gills broadly adnate, decurrent by tooth, very broad, ventricose, close to almost sub-

distant, thin, at the very first pallid, soon 'clay color' to 'buck-thorn-brown' (Ridg.). Stem 3–5 (6) cm. long, 2–4.5 mm. thick, equal, or slightly tapering upwards, subflexuous in age, stuffed, concentrically white-zoned from the delicate veil, zones terminating above middle of stem in a flaring, membranous, whitish annulus, white-scurfy above annulus, becoming at length silky or glabrous below, brownish within and without under the veil remnants, fuscescent. Spores subellipsoid, but narrower toward one end, inequilateral in one view, smooth, 10–12 × 5–6.5 μ, pale rusty brown, cystidia scattered on sides of gills, 60–70 × 9–11 μ, narrowly lanceolate above the slender pedicel, hyaline; sterile cells similar but narrower and crowded."



Figs. 40–42. *P. platyphylla:* 40, section of hymenium, a cystidium (a), and spores (b), × 550; 41, a single cystidium, × 550; 42, spores, × 1200. One spore showing the faint minute roughness. All from type specimens.

Habitat: on wet moss under pine and spruce along stream.

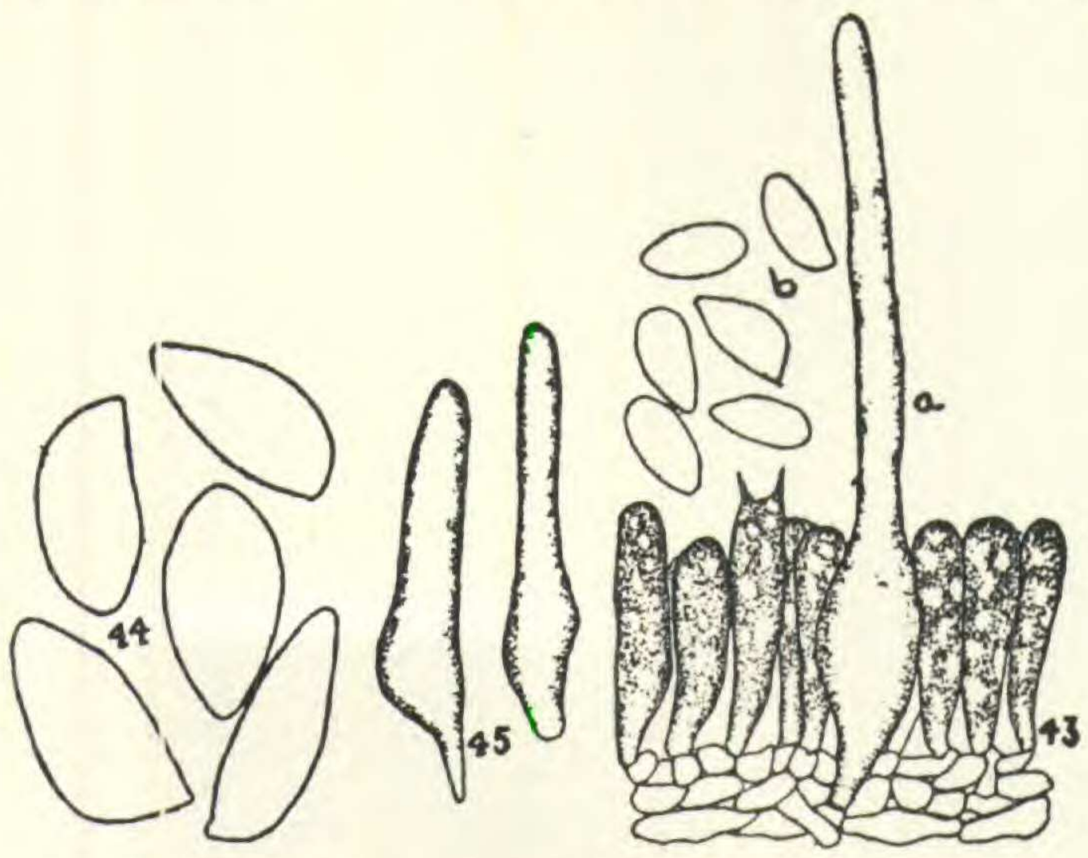
Distribution: known only from the type locality, Tolland, Colo.

I quote above the original description as given by Kauffman. I have seen only a fragment of the type collection but it appears to me to be too close to *P. erebia*, although in my mounts the spores run slightly smaller and the cystidia are much less numerous.

12. Pholiota erebia Fries, Syst. Myc. **1**: 246. 1821. Pl. 11.

Pileus 1–5 cm. broad, convex becoming plane or slightly depressed, rarely slightly umbonate, at first brown or blackish-brown, drying out to umber, then ochraceous-tawny or buck-thorn-brown, or slightly darker in herbarium plants, somewhat viscid when moist, glabrous or with a few white fibers on the margin, even or somewhat reticulate; margin slightly striatulate at times; gills adnate or slightly decurrent, medium-close or slightly distant, 2–4 mm. broad, pallid or grayish, becoming rusty-brown, ochraceous-tawny to cinnamon in dried plants; veil

forming a thin persistent, white, membranous, superior annulus; stem central, equal, brownish below, white and pruinose above the annulus, fibrillose or glabrous below, or at times slightly squamulose at the base, solid, 2.5–7 cm. long, 3–8 mm. thick; spores elongate-elliptic or elongate-ovoid, smooth, 11–15 × 5.5–7.5 μ; cystidia present, usually abundant, hyaline, 7–12 μ broad at the enlarged base, projecting 30–40 μ.



Figs. 43–45. *P. erebia*: 43, section of hymenium showing a cystidium (a), and spores (b), × 550; 44, spores, × 1200 (both from type specimens of *P. aggericola*); 45, isolated cystidia from collection at New York from Bronx Park by Murrill, × 550.

Habitat: on the ground by roadsides and in woods.

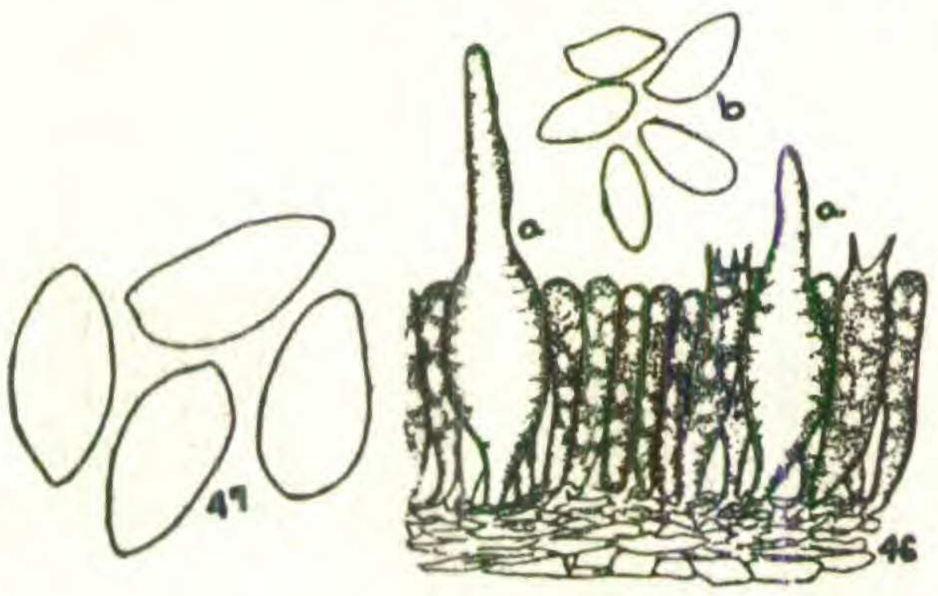
Distribution: specimens have been examined from Waltham, Mass.; Redding, Conn.; Bronx Park, West Park, North Greenbush, and Boltons Landing, N. Y.; Ridgewood, N. J.; St. Louis, Mo.; also reported from Wisconsin by Harper.

This species grades into *P. subnigra*, on the one hand, and into *P. ombrophila*, on the other, and cannot be sharply distinguished from them. In young specimens the pileus is brown or blackish-brown as shown by Peck's drawings on the type sheet at Albany, although the dried plants are distinctly cinnamon in color as they are in most other collections, but occasionally an immature plant retains the blackish color on drying as have the type specimens of *P. subnigra*, a western species, and as have the specimens at New York collected by Seaver in Bronx Park in 1913. Most collections that are referable here rather than to *P. ombrophila* are smaller plants that have narrow gills that are not decurrent, and the opposite of these characters is applicable to *P. ombrophila*. I am of the opinion, however, that we have one variable species which should include *P. aggericola*, *P. subnigra* Murrill, *P. washingtonensis* Murrill, *P. ombrophila*, and *P. erebia*. Ricken states

in the body of his text that the last two named are not distinct, but later he evidently changed his mind and added *P. ombrophila* in the Appendix.

13. Pholiota subnigra Murrill, Mycologia 4: 258. 1912.

Pileus 1.3 cm. broad, convex, slightly umbonate, uniformly fuscous or dusky-drab except on the margin where a hoary pubescence remains from the veil, otherwise glabrous, slightly viscid; gills sinuate-adnate, ventricose, medium-close, becoming fulvous, the edge whitish, 2 mm. broad; veil forming a persistent white superior membranous annulus; stem central, equal, pallid, rough with short soft whitish conic scales pointing upward, solid, 2 cm. long, 2.5 mm. thick; spores somewhat elongate-ellipsoid, smooth, 10–13 × 5–6 μ; cystidia abundant, projecting, conspicuous, flask-shaped.



Figs. 46–47. *P. subnigra:* 46, section of hymenium showing cystidia (a), and spores (b), × 550; 47, spores, × 1200. All from type specimens.

Habitat: attached to a small buried root.

Distribution: known only from the type locality, Seattle, Wash.

b. Plants 4–15 cm. broad at maturity.

aa. Spores smooth (*see also p. 123*).

14. Pholiota ombrophila Fries, Hym. Eur. 216. 1874.

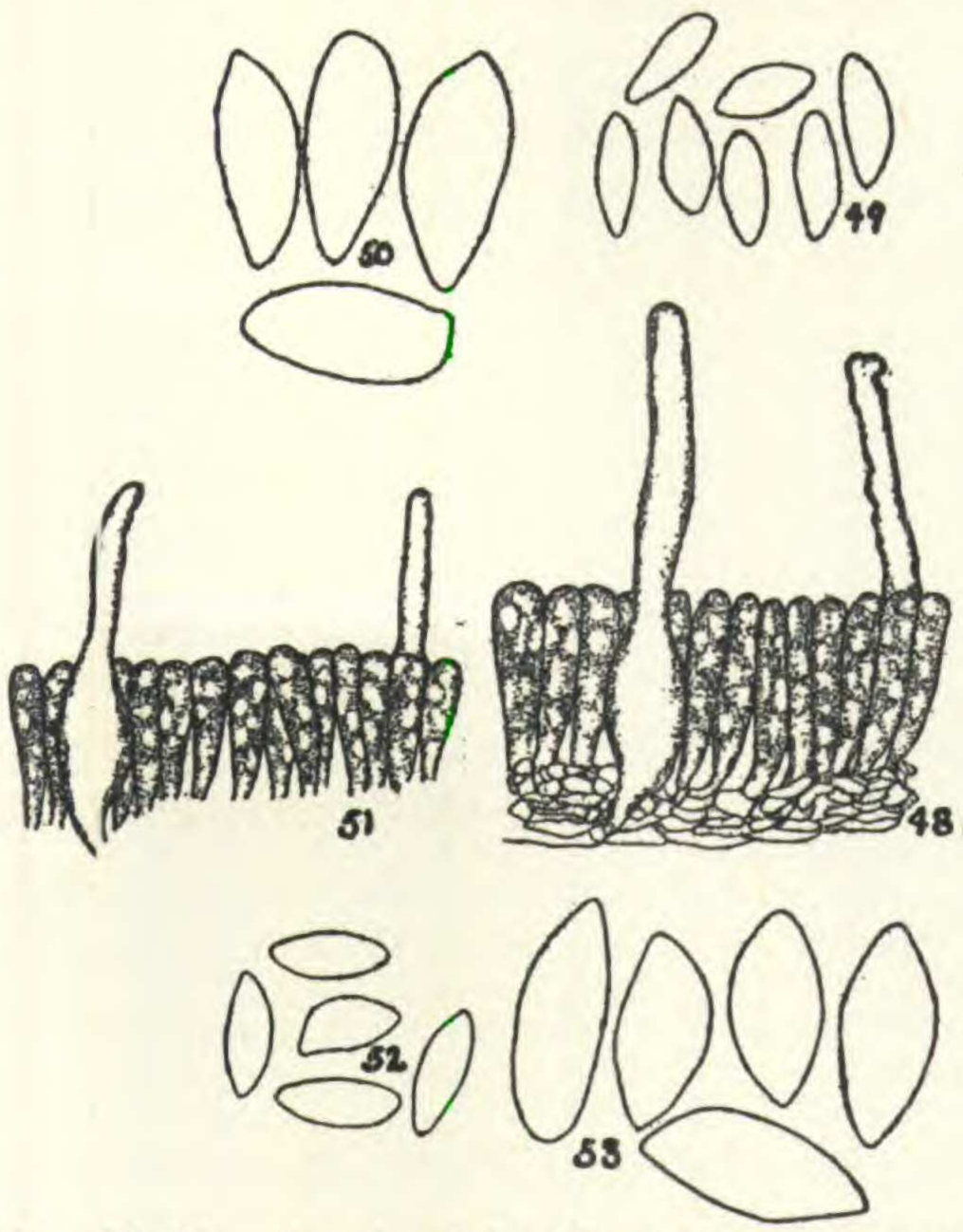
Pileus 3–10 cm. broad, campanulate-convex to nearly plane, dull brown, close to wood-brown or verona-brown, russet or light cinnamon in herbarium specimens, at first with a few white floccose fibers or scales on the margin, soon glabrous, hygrophanous or subviscid when moist; margin even or faintly striate; flesh white or somewhat colored, taste mild, odor none; gills usually decurrent, medium-close or slightly distant, 4–6 mm. broad, clay-color to rusty-brown, the margin white-crenulate in fresh plants; veil forming a median or superior, membranous, broad, conspicuous, often striate, persistent annulus; stem central, equal or

enlarged below, whitish or brownish, often dark below, stuffed or hollow, 4–8 cm. long, 4–15 mm. thick; spores cylindric-elliptic or fusoid-elliptic, smooth, 11–15 × 5–7 μ; cystidia abundant, conspicuous, projecting 20–40 μ, flask-shaped.

Habitat: in grassy places in woods or wooded pastures.

Distribution: specimens have been examined from Oneida, Bronx Park, and Lake Placid, N. Y.; Seattle, Wash.

Illustrations: Fries, Ic. Hym. *pl. 103, f. 2;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 31.*



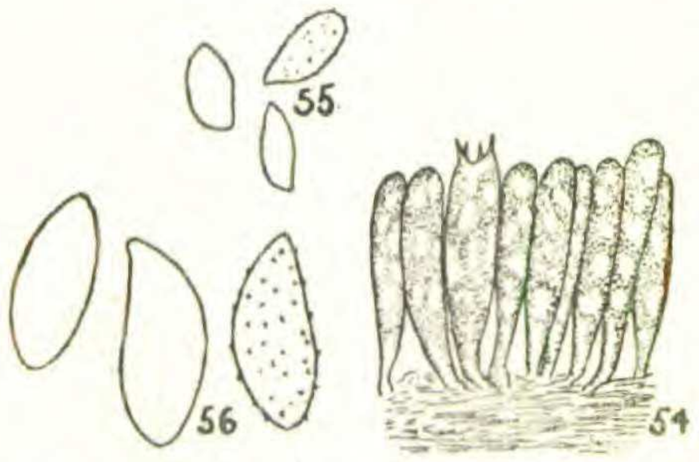
Figs. 48–53. *P. ombrophila:* 48, section of hymenium showing cystidia, × 550; 49, spores, × 550; 50, spores, × 1200. All from specimens at New York from Bresadola. 51, section of hymenium showing cystidia, × 550; 52, spores × 550; 53, spores, × 1200. All from type specimens of *P. washingtonensis.*

This species represents the height of development in a group in which have been described in addition, *P. subnigra* Murrill, *P. aggericola* Peck, *P. indecens* Peck, *P. washingtonensis* Murrill,and *P. erebia* Fries. It cannot be sharply separated from either the first or the last of these and the others must be referred to synonymy. Plants usually retain more of the characteristic umber coloration of the pileus than in *P. erebia,* they are often larger, and the gills are more distinctly decurrent. Sometimes herbarium specimens show the yellowish-brown color usually present in mature dried plants of *P. erebia.* If Harper's spore measurements (8–9 μ long) are correct, his plants cannot belong to this species.

15. Pholiota aurea (Mattuschka) Fries, Syst. Myc. **1:** 241. 1821. Pl. 12.

Agaricus aureus Mattuschka, En. Stirp. Sil. Herbor. 351. 1779.

Pileus fleshy, 10–15 cm. broad, convex to plane, often upturned in age, subumbonate, firm, surface dry, pinkish-buff to cinnamon-buff or ochraceous-buff, or the center more cinnamon, covered with a fine but distinct concolorous scurf that may separate into distinct granulose points much as in *Lepiota granulosa;* margin even, thin, appendiculate; flesh thick, compact, yellowish; gills rounded at the base, rather close, 0.7–2 cm. broad, ochraceous-buff to ochraceous-tawny; veil forming a firm, large, pendulous annulus, lemon-color on the upper side, dark buff beneath, eventually disappearing; stem central, tapering upward from an enlarged base, below the annulus granular scurfy as the pileus, above glabrous or nearly so, concolorous or lighter than the pileus, stuffed or solid, 10–18 cm. long, 2–3 cm. thick, inserted 2–5 cm. into the ground; spores ferruginous in mass, golden-brown under the microscope, narrow ovoid to elongate-ovoid, smooth or perhaps sparingly warted in age, 9–12 × 4–6 μ; cystidia none.



Figs. 54–56. *P. aurea:* 54, section of hymenium showing basidia, × 550; 55, spores, × 550; 56, spores, × 1200. All from Overholts Herb. No. 8364.

Habitat: on the ground under bushes.

Distribution: known only from British Columbia.

The specimens on which my record of this species is based are unique in the character of the covering of pileus and stem, having somewhat, though not altogether, the appearance at times of the granulose covering of the stem and pileus of *Lepiota granulosa,* as is emphasized in Ricken's description of this species.

In KOH solution or in glycerine the spores have a strong tendency to cohere in twos and fours. In most cases they are undoubtedly smooth but I have seen a few that seem to be sparingly marked with prominent echinulate points. At best they are unfavorable objects for study in the particular specimens I have examined.

In his emended description of this species Ricken emphasizes the peculiar covering of pileus and stem and the smooth spores as characters separating *P. aurea* from *P. spectabilis.* Also the spores are larger and somewhat different in shape.

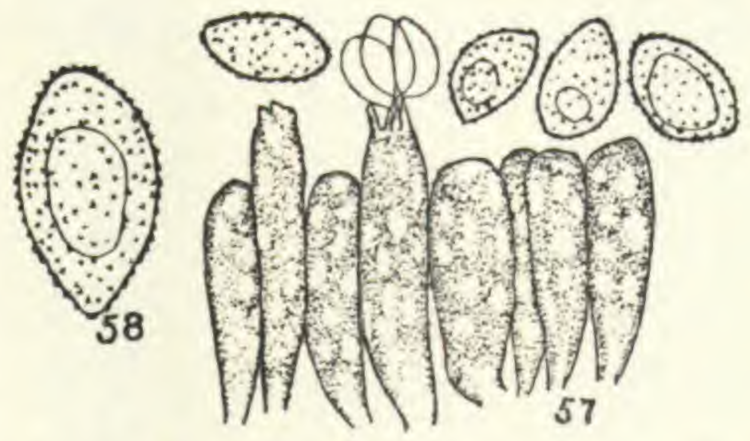
In preparing the paragraph descriptive of this species I have relied largely on the excellent notes sent with the specimens by Mr. W. S. Odell of the Dominion Experimental Farms, Ottawa, Canada.

bb. Spores rough.

16. Pholiota caperata (Pers.) Fries, Syst. Myc. **1**: 241. 1821. Pl. 13.

Agaricus caperatus Persoon, Syn. Fung. 273. 1801.

Pileus 5–15 cm. broad, hemispheric or ovate, then campanulate or convex to nearly plane, ochraceous-buff to ochraceous-tawny, sometimes blackish at the center in dried plants, dry or moist, at first covered with appressed white fibrils that give the pileus a gray appearance and may be more or less arranged in scales, finally more glabrous, especially on the margin, and then likely to be considerably wrinkled or corrugate; margin even, at first incurved; flesh white, taste mild; gills sinuate-adnate or adnate to slightly decurrent, medium-close, 5–15 mm. broad, at first whitish, then clay-color, finally ferruginous, becoming cinnamon in dried plants, usually variegated with close, narrow, light and dark cross-bands and appearing transversely wrinkled, the edge floccose-crenate; veil forming a persistent, superior or almost median, white, deflexed, membranous annulus, sometimes striate on the upper side; stem central, equal, white or slightly yellowish, floccose-tomentose above the annulus, glabrous or slightly fibrillose below, sometimes with a definite annular ring just at the base—the remains of the universal veil—solid, 6–15 cm. long, 7–25 mm. thick; spores broadly and inequilaterally elliptic, echinulate, 11–19 × 7–11 μ; cystidia none.



Figs. 57–58. *P. caperata:* 57, section of hymenium showing basidia and spores, × 550; 58, spores, × 1200. All from Overholts Herb. No. 5241.

Habitat: on the ground in woods.

Distribution: specimens have been examined from Bar Harbor, Me.; Ontario, Canada; Stow, Mass.; Chappaqua, Adirondack Mts., West Ft. Ann, and Gansevoort, N. Y.; Lamar, Stone Valley,

and Reitz Gap, Pa.; also reported from Michigan by Kauffman and by Harper.

Illustration: Bresadola, Fung. Mang. *pl. 48;* Fl. Dan. *pl. 1675;* Gillet, Champ. Fr. *pl. 520* (*518*); Harper, Trans. Wis. Acad. Sci. **17:** *pl. 24;* Hard, Mushrooms, *f. 212;* Peck, Rept. N. Y. State Bot. **54:** *pl. 73, f. 1–5;* Ricken, Blätterp. *pl. 55, f. 2.*

Among the true Pholiotas this species is a characteristic one by reason of the floccose fibers on the young pileus, the bright color, the conspicuous transverse banding on the gills of both fresh and dried plants, and the large, elliptic or lemon-shaped, rough spores. In most instances the so-called volva at the base of the stem is not visible in dried plants, and the genus *Rozites*, to which the species is often referred, is scarcely tenable. The nature of this basal ring is the same here as in certain large species of *Coprinus*, and in the light of recent morphological studies is the remnant of the universal veil in which, to greater or less degree, most fleshy agarics are at first enclosed. The species represents an intermediate condition, therefore, in regard to veil development, between those forms in which a definite volva results, and those in which the enclosing fibers are too scanty to leave such a trace.

P. Mcmurphyi, described from California, probably represents the Pacific Coast form of this species.

In age, plants of this species present an often misleading similarity to *Hypholoma rugocephalum*, in which the pileus colors are almost identical and the spores strikingly similar.

17. Pholiota Mcmurphyi Murrill, Mycologia 4: 260. 1912.

Pileus 4–8 cm. broad, convex to nearly plane, rather thick and fleshy, greenish-yellow at the margin, orange-cinnamon at the center, ochraceous-orange to tawny when dry, slimy-viscid, glabrous; flesh white, without characteristic taste or odor; gills adnate or slightly sinuate, close, soon brownish, 4–8 mm. broad; veil forming an inconspicuous, fibrillose, superior, torn annulus; stem central, equal, yellowish-white, solid, below the annulus rough with several conspicuous ridges, 4–6 cm. long, 1–2 cm. thick; spores ovoid or elliptic, quite rough, 13–17 (–21) × 7–7.5 (–10) μ; cystidia none.

Habitat: on the ground among leaves in oak woods.

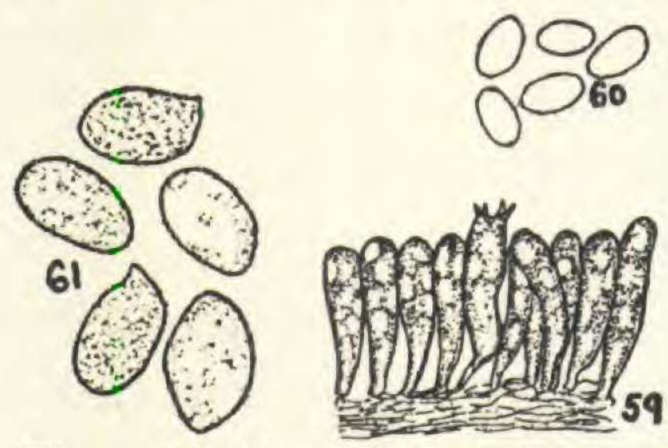
Distribution: known only from the type locality, Searsville Lake, Cal.

This species is close to, if not identical with, *P. caperata*, with which it agrees microscopically. There is present on the gills of dried plants to some extent the peculiar appearance of cross-bands, as characteristic of *P. caperata*, but they are not nearly so well marked and indeed are scarcely noticeable in one of the two mature specimens in the type collection. The peronate stem is different also, and the annulus is of a more delicate texture and more evanescent.

2. Plants with small spores up to 9 μ long.
a. Spores rough-walled (*see also p. 126*).

18. Pholiota minima Peck, Rept. N. Y. State Mus. **41:** 65. 1888.

Pileus 3–8 mm. broad, hemispheric or campanulate, umbonate, brown when moist, pale buff or yellowish-white when dry, brown in herbarium specimens, hygrophanous, glabrous, margin striatulate when moist; gills adnexed, subdistant, ferruginous, cinnamon in dried plants, 1–2 mm. broad; veil forming an evanescent, median or superior annulus; stem central, equal, concolorous with the pileus, shining, glabrous, solid, 1–2.5 cm. long, 1–2 mm. thick; spores ovoid or elliptic, minutely asperulate, 6–8.5 × 3.5–4.5 μ; cystidia none.



Figs. 59–61. *P. minima:* 59, section of hymenium showing basidia, × 550; 60, spores, × 550; 61, spores, × 1200. All from type specimens.

Habitat: among hair-cap mosses.

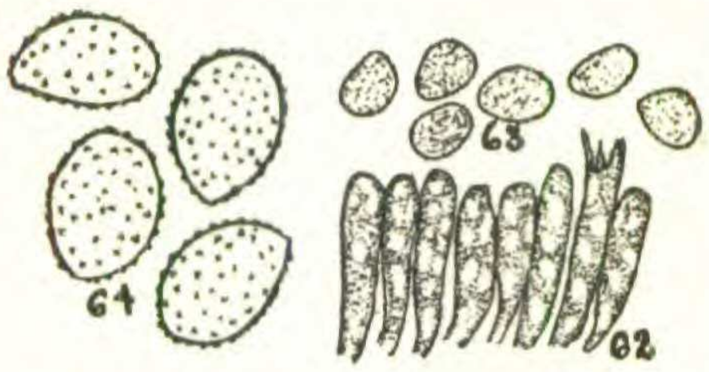
Distribution: specimens have been examined from the Catskill Mts., N. Y.; Auburn, Ala.

The minute roughness of the spores is likely to be unnoticed under the usual 4-mm. objective, but comes out well under the oil-immersion lens.

19. Pholiota trachyspora Clements & Clements, Crypt. Form. Colo. No. 373. 1906.

Pileus 2.5–6 cm. broad, convex or plane, deep golden- or coffee-

brown to dark melleous, entirely covered with matted floccose fibrils of the same color or these collected into squamules particularly at the center of the pileus, dry; gills adnate to adnexed, deep brown, medium-close, 3–6 mm. broad; veil forming a persistent or evanescent, superior annulus; stem central, equal, fibrillose, umber-brown, 4–8 cm. long, 4–10 mm. thick; spores broadly ovoid or subglobose, dark under the microscope, decidedly rough-walled, 7–9 × 5–6 μ; cystidia none.



Figs. 62–64. *P. trachyspora:* 62, section of hymenium showing basidia, × 550; 63, spores, × 550; 64, spores, × 1200. All from type specimens.

Habitat: on the ground in woods.

Distribution: known only from the type locality, Sugar Loaf Park, Colo.

The above description is drawn from the dried specimens as distributed (*l. c.*) by Clements. A collection from Tennessee in the herbarium of the New York Botanical Garden bears strong resemblance to this species, but is not admitted at present. The plants are decidedly dark-colored in the dried state. The subglobose spores are unlike anything else in the genus *Pholiota*. A photograph accompanying the exsiccati specimens shows a well-formed annulus in mature plants. In some respects the plants resemble species of *Cortinarius*.

b. Spores smooth.

aa. Plants 1–3 cm. in diameter; from the Pacific Coast only (*see also p. 128*).

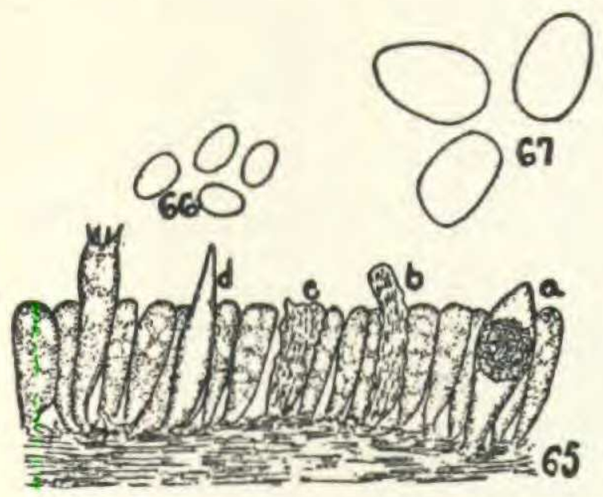
20. Pholiota terrestris Overholts, N. Am. Fl. **10**: 268. 1924.

Pileus 1–3 cm. broad, convex, uniform sayal-brown to cinnamon-brown in dried plants, dry, squamulose with appressed, dark-colored, fibrillose scales or the margin fibrillose only; gills adnate or slightly decurrent, medium-close, 2–4 mm. broad, bright cinnamon; veil ample, membranous, not forming a distinct annulus but sometimes adhering considerably to the margin of the pileus; stem central, equal, pallid above, brown below, the apex floccose, distinctly scaly below the sheathing veil remnants

on the stem, 3–6 cm. long, 2–5 mm. thick; spores oblong-ellipsoid, smooth, 5.5–6.5 × 3.5–4.5 μ; cystidia of several inconspicuous types, none projecting strongly, some brown or with a brown mass within.

Habitat: on a lawn.

Distribution: known only from the type locality, Corvallis, Ore.

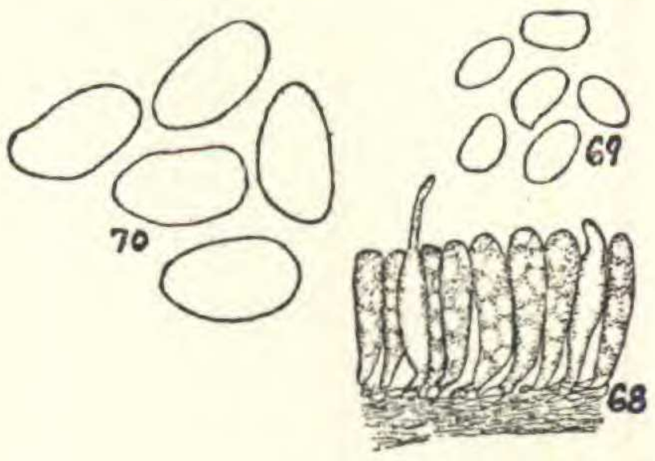


Figs. 65–67. *P. terrestris;* 65, section of hymenium showing basidia and several types of inconspicuous cystidia, × 550; 66, spores, × 550; 67, spores, × 1200. All from type specimens, in New York Botanical Garden Herbarium.

The species approaches *P. angustipes* of the East but the spores are somewhat smaller, the stem more scaly, and the cystidia more conspicuous. These latter organs are typically clavate-fusoid, with a slightly projecting tip and a distinct ball-like content that has a strong affinity for the eosin stain, so that sections left in it for half an hour show these sterile structures extremely well. *P. terrigena* of Europe is similar, but according to specimens from Bresadola has spores 8–9 μ long and entirely lacks cystidia. Harper's plants referred to *P. terrigena* seem to belong here and he gives the smaller spore record of this species.

21. Pholiota anomala Peck, Bul. Torr. Bot. Club **22:** 202. 1895.

Pileus 1.5–2.5 cm. broad, at first hemispheric or sub-conical, then convex, broccoli-brown when moist, pale yellow or cream-color when dry, warm-buff in dried plants, hygrophanous, glabrous; gills adnate or decurrent, medium-close or slightly distant, 3–4 mm. broad, pale, becoming brownish-ferruginous, ochraceous-orange to cinnamon in dried plants; veil forming a slight, finally evanescent, annulus; stem central, equal, fibrillose or glabrous, whitish or brownish, hollow with irregular transverse partitions or the cavities filled with a cottony tomentum, 3–6 cm. long, 2–6 mm. thick; spores oblong-ellipsoid, smooth,



Figs. 68–70. *P. anomala:* 68, section of hymenium with a single narrow cystidium-like body, × 550; 69, spores, × 550; 70, spores, × 1200. All from co-type specimens from the McClatchie Herb. at New York.

very dilutely colored, 7.5–10 × 4–5 μ; cystidia present, or so rare as to pass unnoticed, not conspicuous, clavate and attenuate, sometimes to a long whip-like point that projects 10–15 μ beyond the basidia, 40–50 × 5–7 μ.

Habitat: on sticks and leaves on the ground.

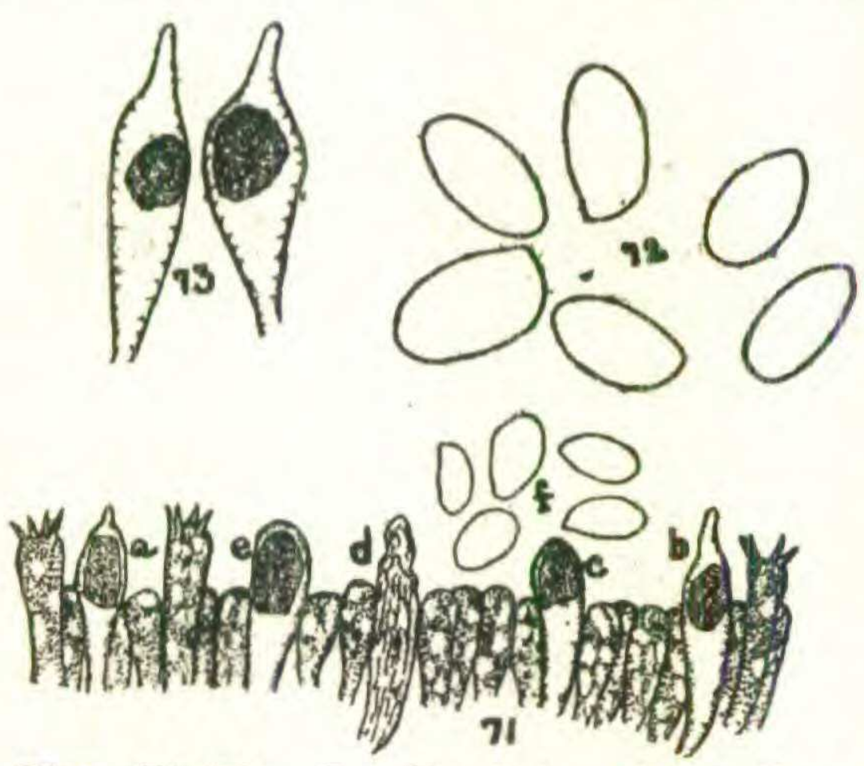
Distribution: known only from Pasadena, Cal.

The type specimens at Albany are in a far better state of preservation than those in a collection from the McClatchie Herbarium at New York. The gills in mature plants are strongly decurrent and the annulus is nearly or quite gone. Sections of the stem show the peculiar-chambered internal structure in good shape. The organs described above as cystidia may prove to be quite different in their origin from true cystidia, and probably their importance should not be stressed. The species has not been recognized since its discovery and its affinities are in doubt.

bb. Mature plants more than 3 cm. in diameter.

22. Pholiota albivelata Murrill, Mycologia **4:** 260. 1912.

Pileus 2–6 cm. broad, convex to plane, sometimes somewhat umbonate, isabelline tinted with rose, resembling the color of some species of *Gomphidius*, the umbo slightly darker, honey-yellow to light clay-color in herbarium specimens, slimy-viscid, glabrous; gills adnate or slightly sinuate, ventricose, medium-close or slightly subdistant, becoming fulvous, the edge white-crenate; veil forming a large erect or pendant, superior or median, persistent annulus, pure white on the lower side, the upper side brown from the spores and striate from the gills; stem central, equal, usually heavily white-floccose just below the annulus, pruinose or slightly floccose above, becoming subglabrous and rarely yellowish toward the base, solid or hol-



Figs. 71–73. *P. albivelata:* 71, section of hymenium showing different types of cystidia (a–e), and spores (f), × 550; 72, spores, × 1200; 73, isolated cystidia showing the rounded body near the apex, × 550. All from Overholts Herb. No. 6027.

low, 5–8 cm. long, 4–10 mm. thick; spores ovoid to narrow-ellipsoid, smooth, slightly apiculate at one end, 7.5–9 × 4.5–5.5 μ; cystidia abundant, not projecting conspicuously, small, hyaline with a rounded conspicuous dark-staining body in the apex, sometimes pointed, but more often obtuse, 30–35 × 7.5–9 μ.

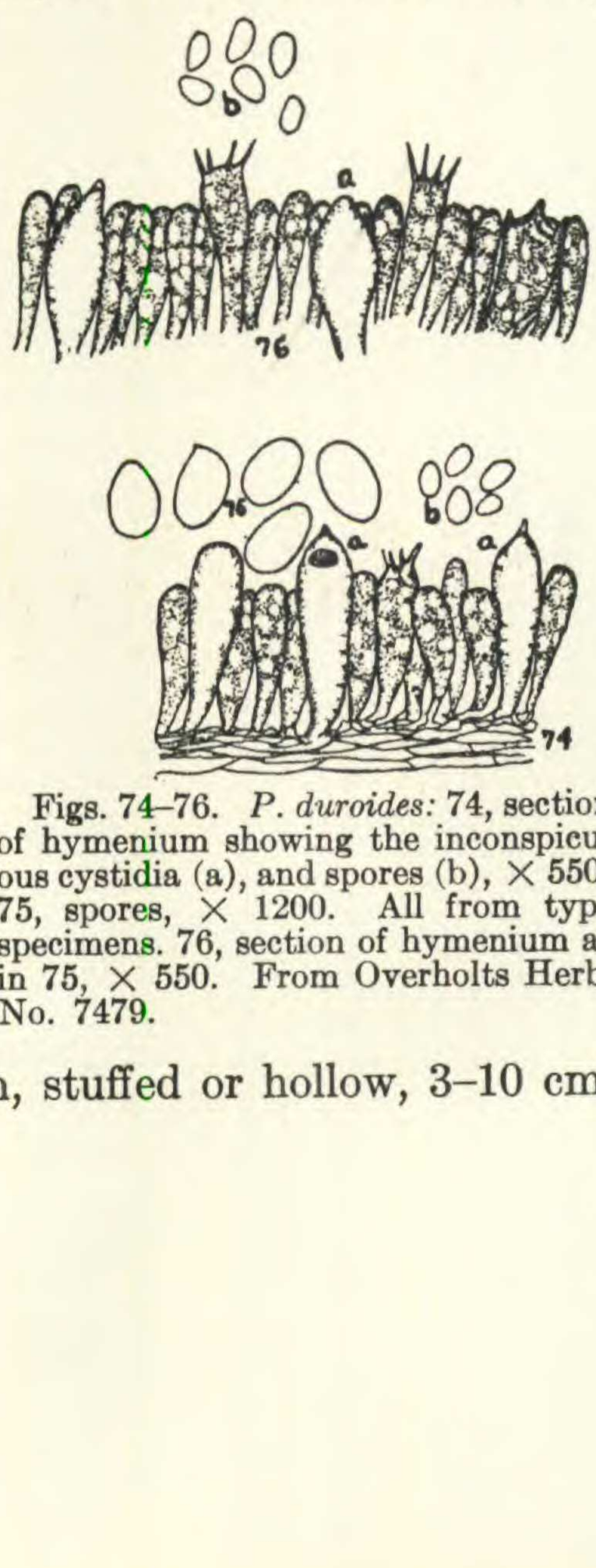
Habitat: on the ground in woods.

Distribution: specimens have been examined from Seattle, Wash.; Salem, Newport, and Glen Brook, Ore.

This species is fairly well represented at New York. The heavy white tomentum on the stem just below the annulus is a marked character in most specimens. The cystidia with their colored contents are different from those of any other species, and while they do not project conspicuously, yet through their abundance they are not likely to be overlooked.

23. Pholiota duroides Peck, Bul. N. Y. State Mus. 122: 148. 1908.

Pileus 2.5–9 cm. broad, convex becoming nearly plane, dry or moist but not hygrophanous, creamy-white to ochraceous-buff, chamois, cinnamon-buff or nearly ochraceous-orange, retaining these colors on drying, glabrous or slightly appressed-squamose or with spot-like scales or depressions in the center, margin even; flesh white, taste mild; gills adnexed or sinuate-adnate, sometimes with a decurrent tooth, close, narrow, 2–5 mm. broad, whitish becoming brown or rusty-brown, with a white-crenulate edge, cinnamon-buff or snuff-brown when mature; veil forming a superior, white, membranous, pendant or rolled, subpersistent annulus, often striate on the upper side; stem central, equal or enlarged below, glabrous, or at times fibrillose-scaly below, whitish, stuffed or hollow, 3–10 cm.



Figs. 74–76. *P. duroides:* 74, section of hymenium showing the inconspicuous cystidia (a), and spores (b), × 550; 75, spores, × 1200. All from type specimens. 76, section of hymenium as in 75, × 550. From Overholts Herb. No. 7479.

long, 4–15 mm. thick; spores ellipsoid or ovoid, smooth, 4–6 × 3–4.5 μ; cystidia present, obtuse, not projecting strongly yet rather conspicuous in point of size, often mucronate-tipped, 8–11 μ in diameter.

Habitat: on the ground in waste places, especially in open woods.

Distribution: specimens have been examined from Stony Brook and Easton, Mass.; Redding, Conn.; Mount Vernon, Bronx Park, and Syracuse, N. Y.; Delaware Water Gap and Stone Valley, Pa.; White Post, Mountain Lake, and Blacksburg, Va.; Unaka Springs, Tenn.; St. Louis, Mo.

The species is well represented in the herbarium of the New York Botanical Garden. Many of the collections had been referred to the genus *Stropharia*, due possibly to the peculiar color of the gills. In fact the plant scarcely has the appearance of a *Pholiota*, and dried specimens sometimes resemble thin dried plants of *Russula foetens* or *R. pectinata* in color, though some are distinctly colored, and in one collection from Blacksburg, Va. the color is such a distinct reddish-tan that it is close to ochraceous-orange of Ridgway. The annulus varies considerably but is typically pendant as compared with the cottony roll of the annulus of *P. Johnsoniana*.

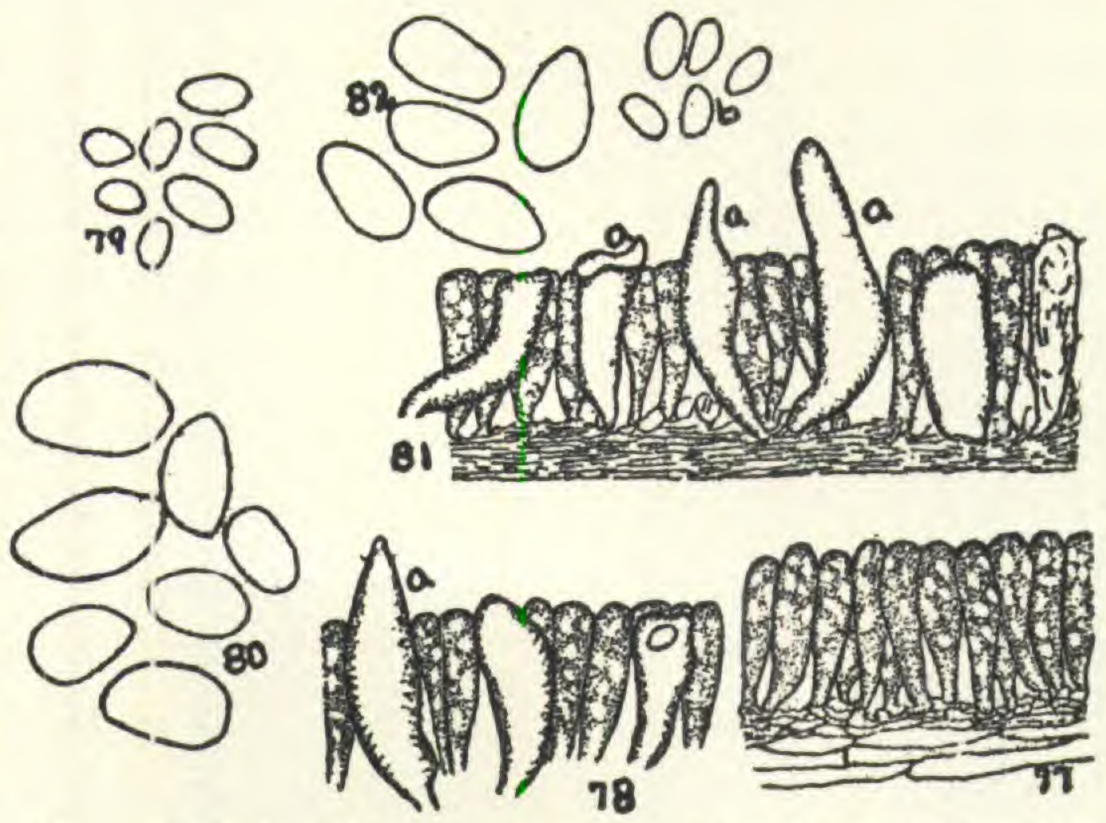
Considerable confusion has resulted from attempts, initiated by Peck, to draw a parallel between this species and *P. dura,* to which it is not closely related. The very narrow gills, between buffy-brown and Dresden-brown in color, and the small spores make this a distinct species. It may be advisable to separate from it the darker-colored forms with pileus with a spotted appearance, but that course seems scarcely justified at present. Harper describes (Trans. Wis. Acad. Sci. **17:** 476. *pl. 25.* 1912) unnamed collections of what are in all probability this species from Wisconsin.

24. Pholiota Johnsoniana (Peck) Atkinson, Mushrooms, 153. 1900.

Agaricus Johnsonianus Peck, Rept. N. Y. State Cab. **23:** 98. 1872.

Pileus 3–10 cm. broad, convex or nearly plane, thick at the

center and thin on the margin, yellowish or ochraceous, or yellow in the center and white on the margin, more or less cinnamon-buff in dried specimens, glabrous or at times with small appressed squamules in the center, dry; margin thin and sometimes striatulate; flesh white, flavor agreeable; gills adnate or sinuate-adnate, close, 2–5 mm. broad, whitish then rusty-brown, snuff-brown to bister in dried specimens; veil forming a thick, white, persistent annulus; stem central, equal, glabrous, light-colored, solid, slightly striate at the top, 7–10 cm. long, 0.8–1.5 cm. thick; spores ovoid or ellipsoid, smooth, 5–8.5 × 3–4 μ; cystidia scarcely noteworthy in some plants and quite conspicuous in others, some imbedded and blunt, others projecting, usually pointed.



Figs. 77–82. *P. Johnsoniana:* 77, section of hymenium showing basidia, × 550; 78, section of hymenium showing inconspicuous cystidium (a), × 550; 79, spores, × 550; 80, spores, × 1200. All from type specimens. 81, section of hymenium with cystidia (a), and spores (b), × 550; 82, spores, × 1200. All from Overholts Herb. No. 3946.

Habitat: on grassy ground in pastures or in leaf mold in woods in late summer.

Distribution: specimens have been examined from Redding, Conn.; Knowersville and Bronx Park, N. Y.; State College, Pa.; also reported from North Carolina by Atkinson and from Michigan by Kauffman.

Illustrations: Atkinson, Mushrooms, *pl. 49 (44), f. 149 (145);* Murrill, Mycologia **7:** *pl. 163, f. 10;* Peck, Rept. N. Y. State Cab. **23:** *pl. 3, f. 4–6.*

Atkinson and Kauffman stress the turbinate shape of the pileus as a character for recognizing the species. In the one collection of fresh plants I have seen this character was not particularly pronounced, and in the type specimens is not evident in their present condition although shown in two of the three illustrations

published by Peck. The species has some of the aspects of *P. praecox*, but has smaller spores, lacks the cystidia of that plant, and the annulus persists as a distinct cottony roll on the stem. The cluster of stellate crystals mentioned by Kauffman as occurring among the basidia are apparent in the type specimens only on the edge of the gills. They are needle-shaped and arranged in a stellate manner. The closest relative of this plant is undoubtedly *P. duroides*, and on the basis of the type material at Albany I have been unable to cite a single distinguishing character. Microscopically they are closely alike. The spores of *P. duroides* are constantly less than 6.5 μ long; those of *P. Johnsoniana* vary between 5 and 8.5 μ and are slightly more irregular in shape. The cystidia of *P. duroides*, types, are not conspicuous but are present as slightly projecting mucronate-tipped organs much larger than the basidia. In *P. Johnsoniana*, types, they are perhaps even less conspicuous. In other collections referable to the one or the other of these two species they are usually more conspicuous than in either of these, and readily distinguishable in crushed preparations of the gills. Some of them do not project and would seem to be the old post-mature basidia.

As interpreted by recent writers, *P. Johnsoniana* does not have quite the appearance of *P. duroides*. The latter most often has the habit of a *Russula* with short and comparatively thick stem, while *P. Johnsoniana* has more the appearance of a slender-stemmed *Agaricus* such as *A. silvicola*. The gills of *P. duroides* are very narrow, while those of *P. Johnsoniana* are considerably broader. The annulus of the latter is a cottony roll on the stem, while that of *P. duroides* is membranous and soon largely evanescent.

B. Growing on wood.

1. Pileus not distinctly scaly (*see also 2, p. 142*).

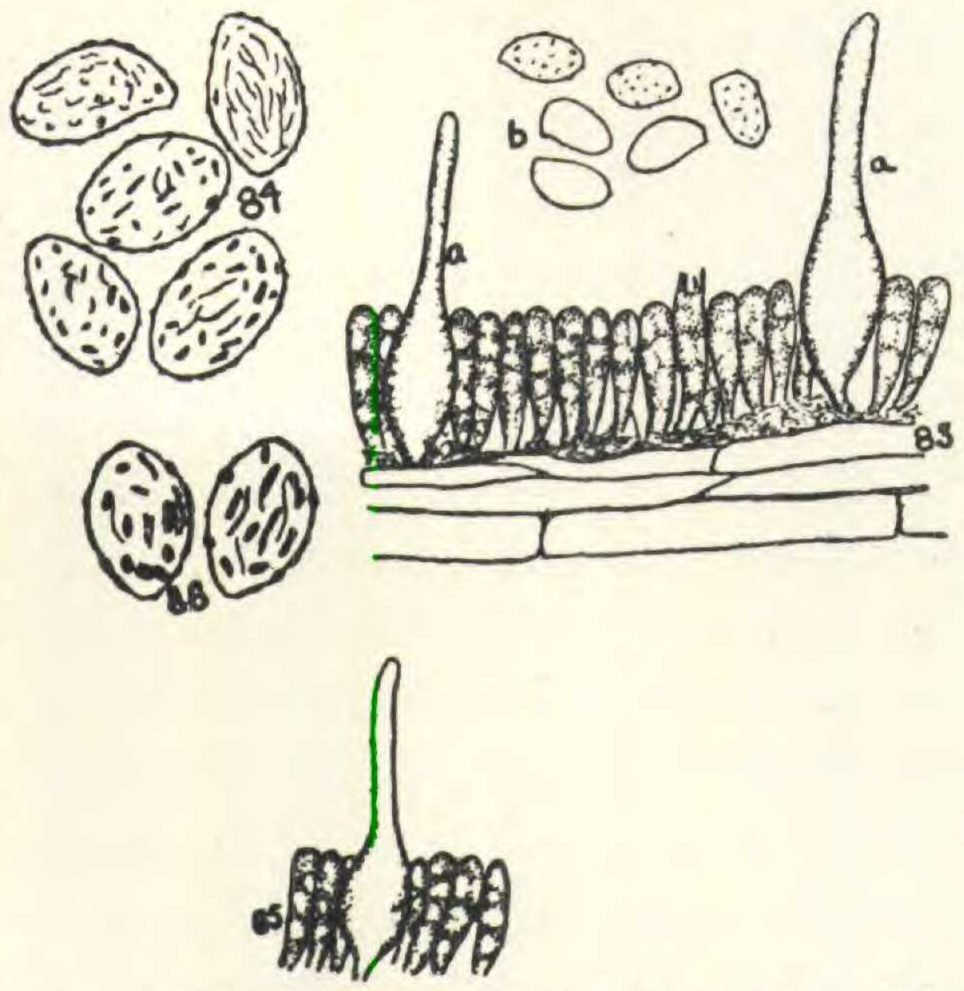
a. Spores rough-walled; prominent flask-shaped cystidia present in the hymenium (*fig. 83*) (*see also b, p. 137*).

25. Pholiota marginata (Batsch) Fries, Epicr. Syst. Myc. 169. 1836–38. Pl. 14.

Agaricus marginatus Batsch, Elench. Fung. 65. 1783.

Pileus 1–7(–8) cm. broad, convex to plane or slightly depressed, sometimes somewhat umbilicate, more rarely slightly umbonate,

argus-brown, cinnamon-brown, or Sudan-brown when moist, warm-buff to ochraceous-orange when dry, usually of the latter colors in dried plants, hygrophanous, glabrous; margin usually striatulate when moist, often extending somewhat beyond the gills; context fleshy, thin, concolorous with the pileus, taste and odor farinaceous; gills sinuate-adnate to adnate or slightly decurrent, medium-close to slightly distant, 2–7 mm. broad, light yellowish-brown to buckthorn-brown; veil forming a fugacious or subpersistent annulus; stem central, nearly equal or somewhat swollen just at the apex, fibrillose, pruinose at the top and with a white tomentum at the base, concolorous or lighter than the pileus, hollow, 2–8 cm. long, 2–6 (–10) mm. thick; spores elliptic or ovoid, often smooth when young, with a rough wall when mature, 7–10 × 4.5–6 μ; cystidia present, but usually not abundant, flask-shaped with a long apex that projects 15–25 μ, hyaline, 50–80 × 10–15 μ.



Figs. 83–86. *P. marginata:* 83, section of hymenium showing cystidia (a), and spores (b), × 550 (from Overholts Herb. No. 1562); 84, spores, × 1200; 85, section of hymenium with cystidium, × 550; 86, spores, × 1200. All from type specimens of *P. autumnalis*.

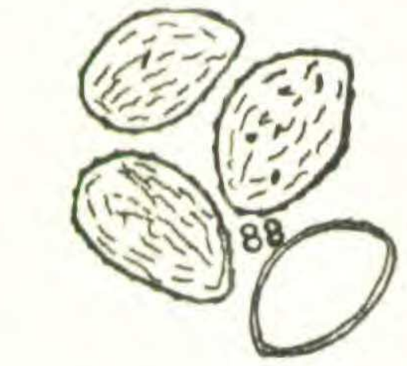
Habitat: on rotting wood, either exposed or buried, of either deciduous or coniferous trees; often on sawdust.

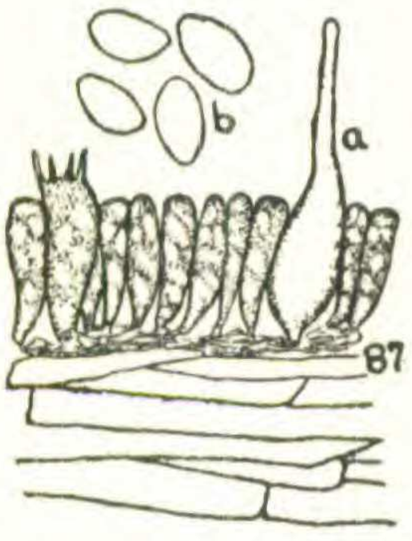
Distribution: specimens have been examined from Natlick, Mass.; Van Cortlandt Park, Ithaca, Karner, and North Greenbush, N. Y.; Auburn, Ala.; State College and Bear Meadows, Pa.; Oxford, Ohio; Falling Springs, Ill.; Creve Coeur Lake, Wicks, Meramec Highlands, and St. Louis, Mo.; Minnesota; Vancouver Island; also reported from Michigan by Kauffman.

Illustrations: Atkinson, Mushrooms, *f. 143 (147)*; Cooke, Ill. Brit. Fungi, *pl. 372 (403)*; Hard, Mushrooms, *f. 215;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 54, 55;* Ricken, Blätterp. *pl. 56, f. 7.*

Under this name I have listed one of our most common species on old logs in woods from spring to fall. It differs from *P. marginella* in the larger, rough spores, and in the presence of cystidia. *P. discolor* differs largely only in the viscid pileus and the brighter colors on drying. I have been at much loss as to how the species may differ from *P. unicolor*, as they seem very closely related if indeed there is a separating character of enough constancy to enable one to distinguish the one from the other. On the Pacific coast there is an apparently common plant which dries a bright color, has a persistent, well-developed, superior membranous annulus, and the spores are less roughened or altogether smooth. Also, the stem is slender, scarcely more than 1–2 mm. thick. This plant I am calling *P. unicolor*. The same type is also found in the East where these characters seem to be less constant but more or less distinguishable. In *P. marginata* the stem is 2–4 mm. or more thick, has an evanescent and fibrillose, rather than membranous, annulus, and dried plants are more often of a dull brown color. I feel that the two are, however, hardly worthy of separate specific rank. This difference is essentially that of Kauffman, I believe, although he admits plants of somewhat larger size to *P. unicolor*.

Agaricus (*Pholiota*) *autumnalis* Peck is a synonym.





Figs. 87–88. *P. unicolor:* 87, section of hymenium showing a cystidium (a), and spores (b), × 550; 88, spores, × 1200. All from specimens at New York, from Washington, collected by Murrill.

26. Pholiota unicolor (Vahl) Fries, Epicr. Syst. Myc. 170. 1836–38.

Agaricus unicolor Vahl, Fl. Dan. **6**[18]: 7. 1792.

Pileus 0.5–2 cm. broad, campanulate to conic-campanulate or somewhat convex, often sharply umbonate, cinnamon-buff to ochraceous-buff or ochraceous-orange, herbarium specimens cinnamon to ochraceous-tawny, glabrous, hygrophanous, margin striate or fluted; flesh thin, somewhat farinaceous to the taste; gills squarely adnate, often becoming somewhat free with the expansion of

the pileus, rather close, sub-triangular in shape, more or less tawny or ferruginous; veil forming a persistent median or superior, upright, funnel-shaped annulus; stem central, equal, yellowish-brown, decidedly floccose-mealy above the annulus, fibrillose below or the base white-tomentose, hollow, 2.5–5 cm. long, 2–4 mm. thick; spores ovoid or elliptic, smooth or slightly rough when mature, 7.5–10 × 5–6 μ; cystidia rare, projecting, flask-shaped, hyaline, pointed.

Habitat: on rotten wood of coniferous or deciduous trees.

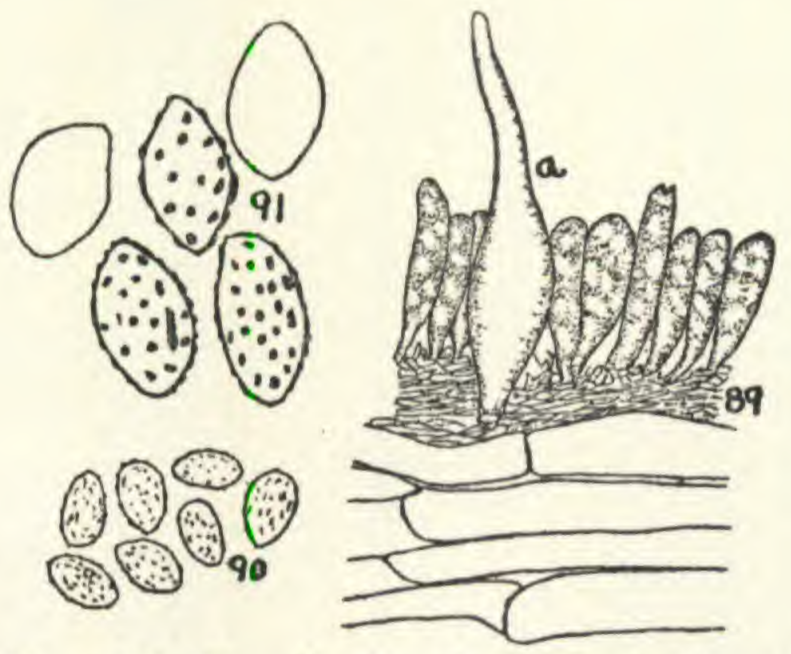
Distribution: specimens have been examined from Piscataquis Co., Me.; Redding, Conn.; Bronx Park and Palisades, N. Y.; Auburn, Ala.; Corvallis and Mill City, Ore.; Seattle, Wash.; Palo Alto, Cal.; also recorded by Kauffman from Michigan.

Illustrations: Bulliard, Herb. Fr. *pl. 530, f. 2* (as *Ag. xylophilus*); Cooke, Ill. Brit. Fungi, *pl. 356 (404), f. b.*

The species is closely related to *P. marginata*, from which the persistent membranous annulus, the less roughened spores, the thinner stem, and the bright colors of dried plants may separate it. See also under *P. marginata*.

27. Pholiota discolor Peck, Bul. Buffalo Soc. Nat. Sci. **1:** 50. 1873. Pl. 15.

Pileus 1–3 (–5) cm. broad, convex then expanded or slightly depressed, cinnamon-rufous, bright ochraceous-yellow when dry, cinnamon-buff, ochraceous-orange, or cinnamon in dried plants, hygrophanous, smooth, viscid, margin striatulate when moist, even when dry; gills adnate or with a decurrent tooth, medium-close or somewhat distant, 1–3 mm. broad, pallid then pale ferruginous, mikado-brown or russet in dried plants; veil forming a subpersistent, distinct annulus; stem central, terete, equal, pallid, fibrillose-striate, hollow, 2.5–8 cm. long, 1.5–5 mm. thick; spores elliptic, rough,



Figs. 89–91. *P. discolor:* 89, section of hymenium showing a cystidium (a), × 550; 90, spores, × 550; 91, spores × 1200. All from type specimens.

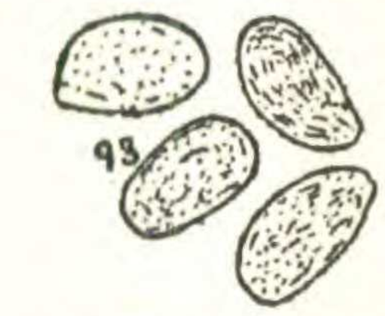
dilute brown under the microscope, 7–9 × 4–6 μ; cystidia present but sometimes rare, projecting 20–40 μ or more, flask-shaped, 40–70 × 10–12 μ.

Habitat: on old logs and on rotten wood.

Distribution: specimens have been examined from Greig and Gansevoort, N. Y.; Edgewater, N. J.; Washington, D. C.; Auburn and Montgomery, Ala.; Creve Coeur and St. Louis, Mo.; also reported from Michigan by Harper and by Kauffman.

Illustrations: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 61B.*

While very closely related to *P. marginata* it seems possible to distinguish *P. discolor* by the viscid pileus and the brighter colors in both fresh and dried plants. Microscopically, the two species are very similar, with spores and cystidia in general the same. Cystidia, however, are quite rare at times and may be difficult to locate but I have never failed to find them. I have noted a tendency for the spores of *P. discolor* to be quite dark in color in sectioned material mounted in KOH—so much so as to give a decidedly darker color to the edge of the basidial layer as seen under the microscope. I am convinced this is an important diagnostic character for this species. Furthermore, this darkening rather effectually obscures the rough character of the spore wall so that spores do not appear so rough-walled as in *P. marginata*. The character of the viscid pileus is confirmed in the notes of several collections, particularly at New York and at St. Louis. *Flammula unicolor* is a quite similar species in the South.



Figs. 92–93. *P. furcata:* 92, section of hymenium showing a cystidium (a), and spores (b), × 550; 93, spores, × 1200. All from type specimens.

28. Pholiota furcata Overholts, N. Am. Fl. **10:** 272. 1924.

Pileus 1–3 cm. broad, convex to plane, somewhat gibbous at times, reddish-brown when moist, ochraceous when dry, cinnamon-buff in dried plants, hygrophanous, glabrous; margin even, at first incurved; flesh concolorous, odor none; gills slightly decurrent, close, ochraceous to dull cinnamon, 2–3 mm. broad, con-

spicuously forked and connected by veins so as to appear somewhat poroid; veil forming a superior, distinct but somewhat evanescent annulus; stem central, equal, dark watery-brown, floccose-pruinose above the annulus, white-fibrillose below, solid or spongy, 1.5–2.5 cm. long, 2–3 mm. thick; spores ovoid or ellipsoid, somewhat rough at maturity, 7.5–9.5 × 4.5–6 μ; cystidia present and fairly abundant, hyaline, flask-shaped, ending in a long projecting tip.

Habitat: on old mossy logs.

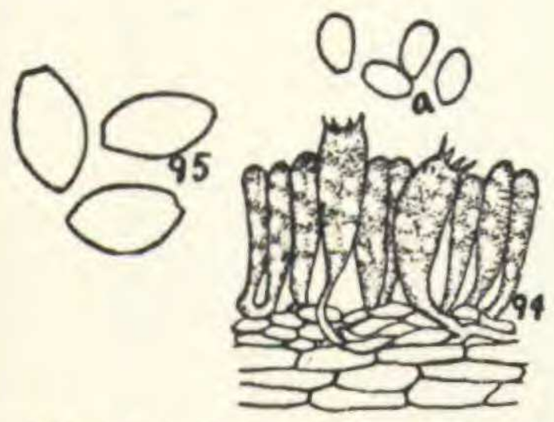
Distribution: known only from Van Cortlandt Park, N. Y. City.

This is the only species of the genus that has forked gills. It may be an anomalous condition that will not be found again, yet the type specimens appear otherwise to be entirely normal. The relationships are with the *P. marginata-discolor* group, as shown by the slightly roughened spores and the flask-shaped cystidia.

b. Spores smooth (*see also c, p. 141*).

29. Pholiota marginella Peck, Rept. N. Y. State Mus. **51:** 289. 1898.

Pileus 1–4 cm. broad, convex becoming nearly plane, buckthorn-brown or yellowish-red when young or moist, whitish or yellowish-buff when dry, warm-buff or cinnamon-buff in dried plants, hygrophanous or at times subviscid, glabrous; young margin striatulate, slightly silky, with whitish fibrils; gills sinuate-adnexed or sinuate-uncinate, easily separating, medium-close, 1–4 mm. broad, minutely eroded on the edge, whitish becoming dark ferruginous; veil forming a slight or well-developed fugacious annulus; stem central, equal, fibrillose below, pruinose above the annulus, stuffed or hollow, whitish or pallid, sometimes with a white tomentum at the base, 3–10 cm. long, 1–6 mm. thick; spores ellipsoid or ovoid, smooth, slightly truncate at one end, brown, 6–8 (–9) × 3.5–4.5 μ; cystidia none.



Figs. 94–95. *P. marginella:* 94, section of hymenium showing spores (a), × 550; 95, spores, × 1200. All from type specimens.

Habitat: decaying wood or on sawdust piles.

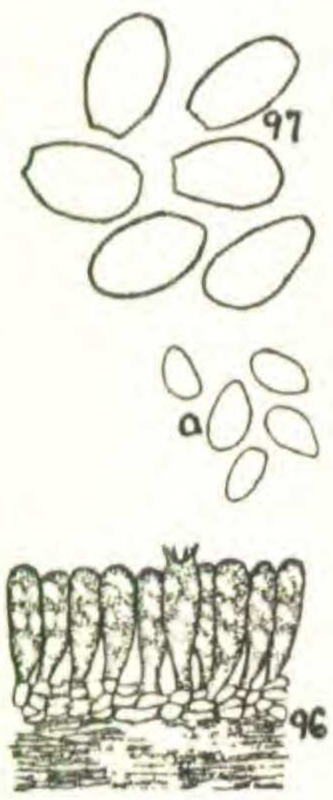
Distribution: specimens have been examined from North Conway, N. H.; North Elba, Bronx Park, and Staten Island, N. Y.; Trenton, N. J.; State College, Bear Meadows, and Stone Valley, Pa.; Oxford, Ohio; Tolland, Colo; Seattle, Wash.; Yakutak Bay, Alaska.

Illustrations: Peck, Rept. N. Y. State Mus. **51:** *pl. B, f. 12–20.*

Though apt to be confused on external appearances with *P. marginata* and *P. discolor* this species is decidedly distinct in the smaller, smooth spores and in the absence of cystidia. It is much more closely related to *P. mutabilis* from which it scarcely differs except in a lack of scaliness on the stem. A favorite haunt for it is an old sawdust pile, and most of the collections examined have been from such a habitat. On drying the pileus is typically much lighter than in *P. marginata* but not so bright as in *P. discolor*. The color is a hue entirely distinct from either of these, and by it alone the species can be recognized. I found it to be the most abundant species in the vicinity of Tolland, Colorado, in 1913 and 1914, and at least a dozen collections are preserved in my herbarium from that locality.

30. Pholiota mutabilis (Schaeff.) Fries, Epicr. Syst. Myc. 169. 1836–38.

Agaricus mutabilis Schaeff. Fung. Bavar. **4:** Ind. 6. 1774.



Figs. 96–97. *P. mutabilis:* 96, section of hymenium with spores (a), × 550; 97, spores, × 1200. All from specimens at New York from Bresadola.

Pileus 1.5–3 cm. broad, convex to plane, cinnamon when moist,paler when dry, ochraceous-buff in dried plants, hygrophanous, glabrous; gills adnate or slightly decurrent, medium-close, 2–4 mm. broad, pallid then cinnamon; veil forming a white or dark, superior, evanescent or persistent annulus; stem central, equal, concolorous with the pileus, decidedly scaly below the ring, pruinose above, stuffed then hollow, 3–7 cm. long, 3–5 mm. thick; spores ovoid or elliptic, slightly truncate at one end, smooth, 6–7.5 × 4–5 μ; cystidia none.

Habitat: on stumps and logs.

Distribution: specimens have been examined from Cleveland and Oxford, Ohio; Gunnison River, Colo.

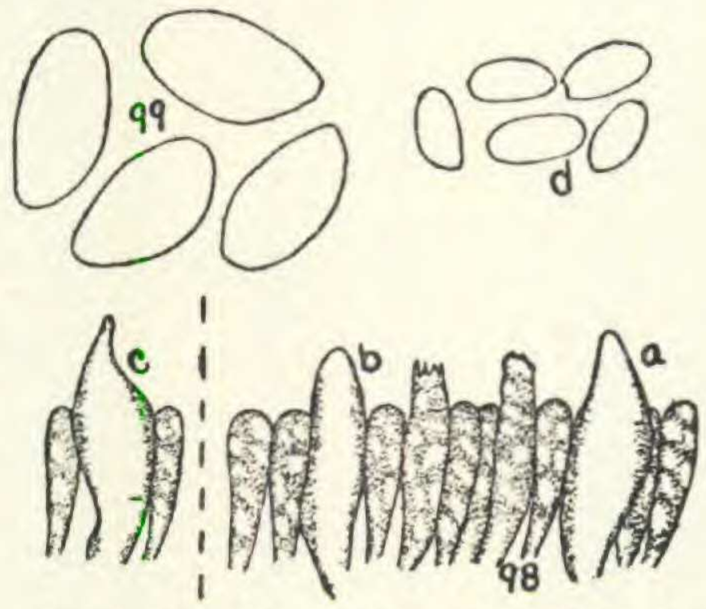
Illustrations: Batsch, Elench. Fung. *pl. 38, f. 208;* Bresadola, Fung. Mang. *pl. 51;* Cooke, Ill. Brit. Fungi, *pl. 355 (402);* Fries, Sverig. Atl. Svamp. *pl. 47;* Lanzi, Fung. Roma, *pl. 76, f. 3;* Schaeffer, Ic. Fung. *pl. 9.*

Apparently the species is much more common in Europe than in America. With us it is quite rare and was reported by neither Harper nor Kauffman. Its external appearance would place it near the *P. marginata* group, among which it is unique in having a distinctly scaly stem, and entirely smooth, slightly truncate and much smaller spores. The stem is scaly with scattered scales up to the annulus, in which character it is distinct from *P. marginella.*

31. Pholiota Aegerita (Brig.) Fries, Epicr. Syst. Myc. 164. 1836–38.

Agaricus Aegerita Brig. Funghi Litogr. Napol. *pl. 1.* 1824.

Pileus 3–13 cm. broad, sub-hemispheric to convex and then expanded, avellaneous to chamois, cinnamon in dried plants, dry, glabrous, rugulose on the margin when young; flesh white, firm; gills adnate or becoming nearly free, sometimes slightly decurrent in lines on the stem, close or medium-close, 4–8 mm. broad, dark brown; veil forming a median-superior, persistent, conspicuous annulus; stem central, nearly equal, brownish, more or less white-fibrillose, solid, 4–15 cm. long, 4–10 mm. thick; spores ovoid or more often elongate-ovoid or elongate-elliptic, smooth, 9–11 × 4.5–6 μ; cystidia present but not conspicuous, projecting somewhat, hyaline, 6–10 μ in diameter, some pointed at the apex.



Figs. 98–99. *P. Aegerita:* 98, section of hymenium showing the inconspicuous cystidia (a–c), and spores (d), × 550; 99, spores, × 1200. All from specimens at New York from Portugal by Bresadola and Torrend.

Habitat: on recently felled trunks or from wounds in deciduous trees.

Distribution: Michigan.

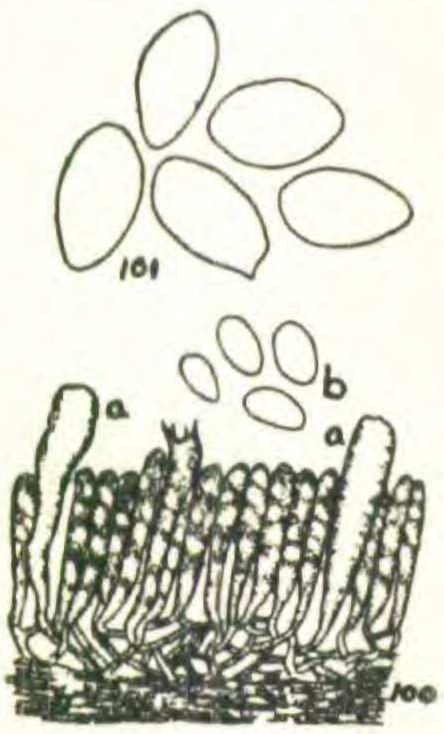
Illustrations: Bresadola, Fungi Mang. *pl. 50;* Briganti, Hist. Fung. Nap. *pl. 32;* Cooke, Ill. Brit. Fung. *pl. 365, 453.*

I have seen no American specimens of this species. It is reported by Kauffman as occurring on debris in low grounds in Michigan. It is a wood-inhabiting form, and specimens at New York from Bresadola and others collected in Europe by Murrill agree quite well with Cooke's illustration which Kauffman says represents aberrant specimens. The colors are similar to *P. praecox* but a deeper tan and the pileus may become areolate, particularly in the variety *strobiloidea.* It was evidently this last character that led Professor Atkinson to concur in designating Harper's plants as this species. It is the only character that his plants have in common with this form of *P. Aegerita,* and the plants are undoubtedly *P. aeruginosa* Peck, which seems to be more common westward.

Only occasionally is the truncate apex of the spore visible to such a marked degree as in *P. Acericola,* but traces of it are occasionally seen. The cystidia seem to present a well-marked characteristic, being rather numerous and projecting only slightly, reminding one of the conditions shown by Dr. Burt for *Stereum ochraceoflavum.*

32. Pholiota oregonense Murrill, Mycologia 4: 262. 1912.

Hypodendrum oregonense Murrill, Mycologia 4: 261. 1912.



Figs. 100–101. *P. oregonense:* 100, section of hymenium showing the inconspicuous cystidia (a), and spores (b), × 550; 101, spores, × 1200. All from type specimens.

Pileus apparently 5 cm. or more broad when mature, convex, obtuse, thick and fleshy, dry, smooth, glabrous, ochraceous-buff to ochraceous-tawny and retaining these colors when dried; margin strongly incurved; flesh thin, cremeous, with an agreeable nutty or amygdaline taste in dried plants; gills adnate, medium-distant to distant, yellow or yellowish-brown, becoming darker, strongly interveined, the edges irregular; veil forming a superior or nearly apical, irregular, yellowish-white annulus; stem central or excen-

tric, terete or compressed, equal or enlarged upward or downward, yellowish above, fulvous below, with small scattered unicolorous subfloccose evanescent scales pointing upward, solid, 6–10 cm. long, 8–20 mm. thick; spores ovoid or elliptic, smooth, 7.5–10 × 3–5 μ; cystidia none or not noteworthy.

Habitat: on decayed spot in trunk of living willow.

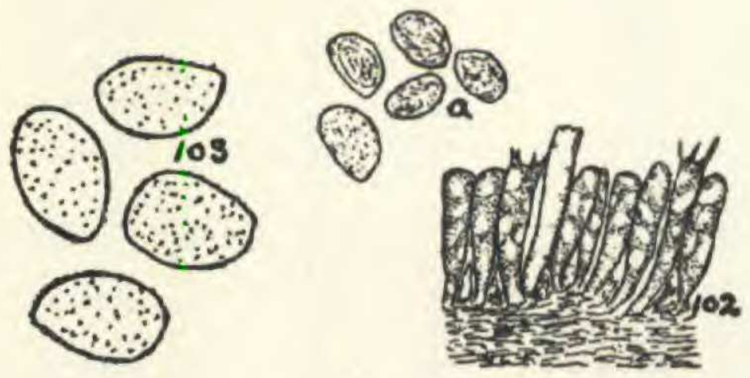
Distribution: known only from the type locality, Glen Brook, Ore.

In outward aspects this species is very similar to *P. spectabilis*. There can be no question, however, that the spores in the types are absolutely smooth and frequently more pear-shaped than ovoid. The specimens are not mature, and it is possible but I think not at all probable that the spores may become rough-walled at maturity. The gills are distant as the plants stand, and the roofs of the gill cavities, at least near the stem, are reticulated with rather conspicuous veins. The gills are not so bright-colored as is usual in *P. spectabilis*. Further study alone can decide as to the status of the species.

c. Spores rough-walled; no cystidia in the hymenium.

33. Pholiota cerasina Peck, Bul. Buffalo Soc. Nat. Sci. **1**: 50. 1873.

Plants cespitose, 5–12 cm. broad, convex to plane, cinnamon-color to tawny, perhaps lighter at times, dry or somewhat hygrophanous, glabrous or nearly so; margin even; context fleshy, rather thin, bitter to the taste, with an amygdaline odor that is best noticed in young plants; gills medium-close or slightly distant, sinuate to adnate or slightly decurrent, yellow, becoming cinnamon or ferruginous, finally pruinose from the spores, 5–12 mm. broad; veil present, forming an early evanescent, spore-stained annulus; stem central or more often excentric, equal or enlarged below, concolorous with the pileus, fibrillose, at least at the apex, solid or stuffed, 5–15 cm. long, 5–12 mm. thick; spores elliptic



Figs. 102–103. *P. cerasina:* 102, section of hymenium with spores (a), × 550; 103, spores, × 1200. All from type specimens.

to ovoid, slightly roughened, brown, 6–9 × 4.5–5.5 μ; cystidia none.

Habitat: on dead wood of deciduous trees.

Distribution: specimens have been examined from Bar Harbor, Me.; Smuggler's Notch, Vt.; Sterling and Mexico, N. Y.

The species is scarcely distinct from *P. spectabilis*, and I have admitted it here only on the basis of Peck's contention that the pileus is hygrophanous—an unusual condition for plants of this type. It cannot be considered distinct in the amygdaline taste, as *P. spectabilis* may be either bitter or amygdaline. I have referred here but a very few collections that seem to match the types exactly. Other collections are in Peck's herbarium so referred, but they depart from the original conception of the species in being decidedly fibrillose and I have referred them to *P. spectabilis*. If there is a hygrophanous *Pholiota* with glabrous pileus in this section, the species will stand; otherwise not. Peck reported it as extremely rare.

34. Pholiota rubecula Banning, Rept. N. Y. State Mus. **44:** 70 (182). 1891.

Pileus 5–6 cm. broad, convex to plane, reddish-brown, dark reddish-brown, or blackish in dried specimens, glabrous, dry; gills adnate or slightly decurrent, 4–6 mm. broad, tawny when dry, rather close; veil not apparent; stem excentric, equal or tapering and rooting at the base, floccose above, glabrous below, solid, 3–6 cm. long, 4–7 mm. thick; spores ovoid or elliptic, 8–9.5 × 4–6 μ, rough when mature; cystidia none.

Habitat: old stumps and trees.

Distribution: known only from the type locality, Baltimore, Md.

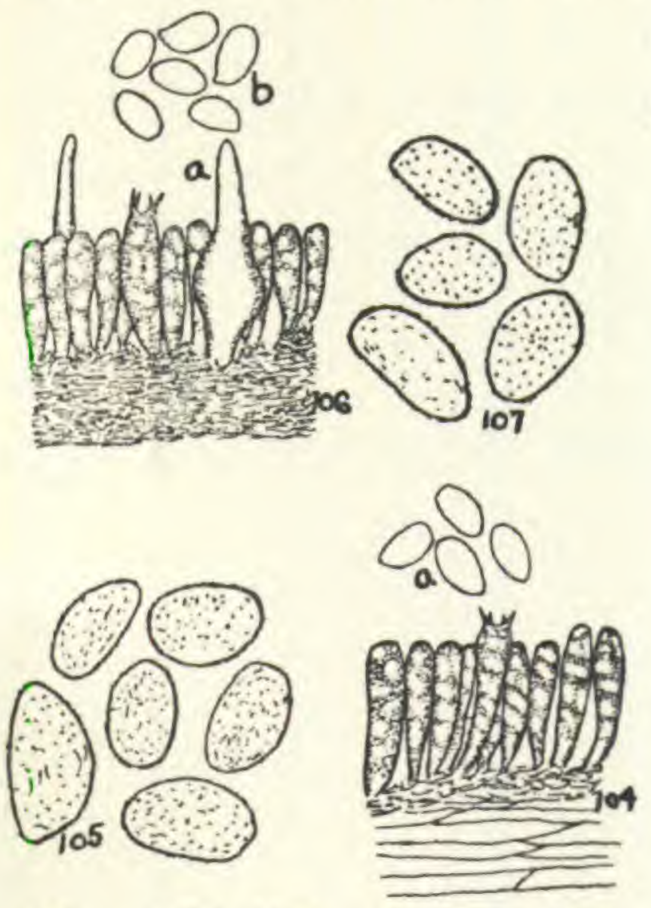
This species has not been recognized since its original publication by Peck. The types still exist at Albany. There are two specimens accompanied by a water-color sketch by Miss Banning. The sketch shows a pileus orange-cinnamon, ochre-red, or tawny, and gills and stem similar but lighter. The color is about that of the pileus of *Lactarius lactifluus*. The specimens show no trace of veil or annulus. The rough spores ally it with the *P. spectabilis* group, among which its affinities are in doubt.

2. Pileus distinctly scaly at maturity.

a. Spores rough-walled (*see also b, p. 148*).

35. Pholiota luteofolia Peck, Rept. N. Y. State Mus. **27:** 94. 1875.

Pileus 2–6 cm. broad, convex, very young specimens dark red or reddish-brown, becoming pinkish-red or yellowish-red when mature, ochraceous-buff or ochraceous-tawny in dried plants, dry, appressed fibrillose-squamulose and sometimes areolate in the center, fibrillose on the margin; context fleshy, thin, typically lavender in fresh plants, bitter; gills adnate or uncinate, sometimes becoming sinuate-adnate, medium-close or somewhat distant, 3–8 mm. broad, yellow becoming bright ferruginous, mostly ochraceous-buff or ochraceous-orange in dried specimens; veil forming a slight, fugacious, spore-stained annulus; stem central or somewhat excentric, equal or enlarged downward, concolorous with the pileus, fibrillose, solid, 3–9 cm. long, 3–10 mm. thick; spores ellipsoid to elliptic, slightly rough, 6–9.5 × 3.5–4.5 μ; cystidia none or not noteworthy.



Figs. 104–107. *P. luteofolia:* 104, section of hymenium with spores (a), × 550; 105, spores, × 1200. All from Overholts Herb. No. 3741. 106, section of hymenium, showing cystidium (a), and spores (b), × 550; 107, spores, × 1200. All from type specimens.

Habitat: dead wood of deciduous trees.

Distribution: specimens have been examined from Forestburgh, West Ft. Ann, and Bronx Park, N. Y.; West Elkton, Ohio; Pacific, St. Louis, and Creve Coeur Lake, Mo.; also reported from Michigan by Kauffman and from Illinois by Harper.

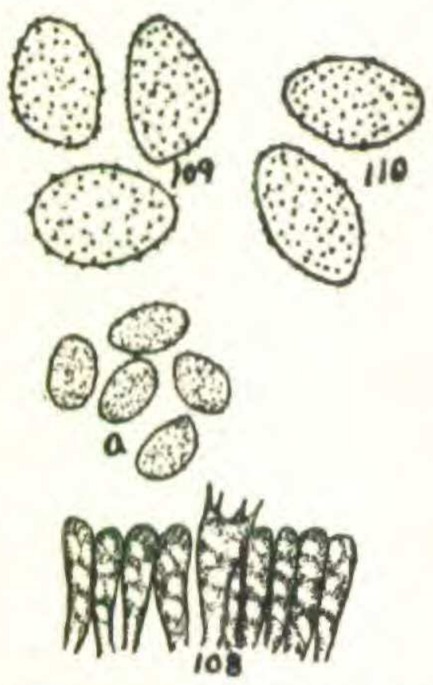
Illustrations: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 48.*

This species is most closely related to *P. aeruginosa*, and further studies may result in rearranging the dividing line between the two species, as some of the collections of the former species examined are without notes concerning salient characters necessary in the identification of dried plants. *P. luteofolia* seems always to lack the green hue of *P. aeruginosa* and does not become so rimose-areolate and the scales appear to be more innate. It is a smaller plant than *P. spectabilis*, and the gills are much brighter-

colored in dried plants. From *P. cerasina* it differs in the distinctly squamulose pileus. The color of mature plants is typically a pinkish-red of about the color of *Lepiota rubrotincta*, but may fade to more pallid or change to yellowish-red in age. Young specimens are darker in color.

36. Pholiota spectabilis Fries, Elench. Fung. 28. 1828.
Pl. 16, 17.

Pileus 4–15 cm. broad, convex becoming nearly plane, buff-yellow to apricot-orange or zinc-orange, becoming at times slightly more brownish (tawny) in dried plants, dry or moist, finely silky or in some very young plants practically glabrous at times, to distinctly fibrillose or rivulose or in mature plants squamulose; margin even; context yellow, taste bitter or amygdaline; gills adnexed to adnate or with decurrent teeth or lines, medium-close, 3–8 mm. broad, yellow becoming ferruginous, yellow-ochre to ochraceous-orange or tawny in dried specimens; veil forming a distinct, superior or apical, spore-stained, persistent or subpersistent annulus, sometimes striate on the upper side; stem central or nearly so, nearly equal to decidedly ventricose or bulbous-enlarged at the base, yellow or tawny, yellow and floccose above the annulus, fibrillose or furfuraceous below, 3–15 cm. long, 0.5–3 cm. thick, solid; spores elliptic, rough, 7–9 × 4.5–6 μ; cystidia none.



Figs. 108–110. *P. spectabilis:* 108, section of hymenium with spores (a), × 550; 109, spores, × 1200. All from type specimens of *P. lutea.* 110, spores, × 1200. From specimen at New York from Bresadola from Holland.

Habitat: on stumps and trunks of deciduous or rarely coniferous trees, or growing from buried wood.

Distribution: specimens have been examined from Toronto, Canada; St. Andrews, New Brunswick; Newfane, Vt.; Pittsfield, Mass.; Monmouth Co., Paterson, and Forked River, N. J.; Frederick, Md.; Washington, D. C.; Montgomery and Birmingham, Ala.; Claryville, Mexico, West Albany, Bronx Park, and Floodwood, N. Y.; St. Louis and Creve Coeur Lake, Mo.;

Berkeley, Cal.; Corvallis, Ore.; Seattle, Wash.; also reported by Kauffman from Michigan.

Illustrations: Bernard, Champ. Roch. *pl. 55, f. 1;* Cooke, Ill. Brit. Fung. *pl. 352 (394)*; Fries, Ic. Hym. *pl. 102;* Gillet, Champ. Fr. *pl. 527 (529)*; Harper, Trans. Wis. Acad. Sci. **17:** *pl. 44, 50;* Kauffman, Agar. Mich. *pl. 61;* Murrill, Mycologia **1:** *pl. 7, f. 4.*

As here admitted, the species is characterized by the usually cespitose habit, the uniform buff-yellow color of pileus and stem, the appressed and usually minute fibrils or fibrillose squamules covering the entire pileus at maturity, the subpersistent, nearly apical annulus, and the rough spores 7.5–9 μ long. I have seen but a single collection in which the young pileus is practically or entirely glabrous, and older specimens in the same collection show the fibrils quite distinctly. In other collections the squamules are large enough to be readily visible to the unaided eye. In every collection examined the annulus has persisted in one or more mature specimens and frequently is well developed. The color of the gills is fairly bright but not quite so bright as in *P. aeruginosa* or *Flammula pulchrifolia.*

In some collections, involving dried plants, I get a distinctly amygdaline taste to the context, although Peck records a bitter taste and Ricken says it is bitter (brennend-bitter) in European plants. In one young collection of dried plants I have obtained a distinctly unpleasant bitter taste from the somewhat worm-eaten context, although the specimens are certainly of the same species as other collections in which the taste is amygdaline. Plants of still other collections are practically tasteless. Most curious of all, in one collection sent from Alabama and described as having an "intensely bitter" taste in the fresh plants I am able to detect an extremely pleasant amygdaline taste in the dried plants.

Nearly always the plants are found around old stumps or in similar situations where buried wood is present, to which they are probably always attached, although this point needs investigation.

That *P. lutea* Peck is in reality this species I think there can be no question, after studying the abundant collections at New York, the European literature, and such European specimens as

are available. As it usually occurs in this country, *P. lutea* is less robust than the European plant. If we take Fries' illustration of this plant as typical of the European species, then our plants mostly differ in not having quite as conspicuous squamules as there shown, even in our most squamulose specimens. I believe, however, that there is no other European illustration that shows so squamulose a pileus as does Fries'. Cooke's illustration (pl. 352) approaches it most closely but here the pileus is shown with appressed rivulose squamules formed by the separation of the long fibers of the cuticle. This type is represented in America, at least on the Pacific Coast. One collection at New York from Berkeley, Cal., 1912, shows this condition almost exactly. In the same category belongs the type collection of *P. ventricosa* Earle, also described from California, but here the plants are not mature enough to illustrate the character as well as in the other California collection. It is also worthy of note that this last collection has stems that are taper-pointed at the base as shown for example in Gillet (Champ. Fr. *pl. 529*), although the other collection agrees with Fries' figure and Cooke's illustration in being obtuse or enlarged at the base. All of these are quite robust and must be considered to be the best-developed type of *P. spectabilis*. But there occurs also, on both our eastern and our western coasts, plants (the collections show only young specimens) in which the stem is fully robust enough to be listed as rather typical *P. spectabilis*, with the obtuse or enlarged stem base. These have uniformly, however, the pileus surface of our typical eastern *P. lutea*. I refer here to specimens at New York from Seattle, Wash., by Parker in 1891, and particularly to a collection from Vermont by Burlingham in 1906. From this condition, the transition to the typical *P. lutea* is easy, where the stem is scarcely bulbous at the base, the plants are medium in stature, and the pileus varies from slightly fibrillose to squamulose.

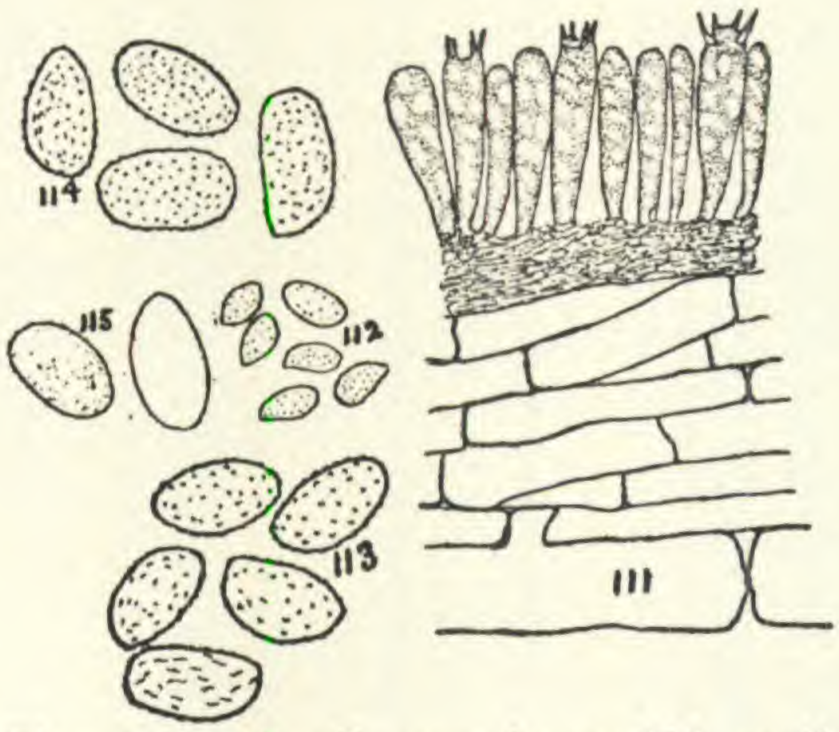
The question may well be asked, "Does the typical *P. lutea* occur as such in Europe?" The answer must be in the affirmative, on the basis of an illustration of *P. spectabilis* published by Bernard in Champ. Rochelle, *pl. 55, f. 1*, where our plant is quite well shown. If Peck had based his species on the types of plants illustrated in this reference and represented by one collection at

New York from Alabama by Earle, another from Bronx Park by Murrill in 1911, and two or three others, there would be more basis for keeping it distinct. For this type represents one extreme of development, the California specimens the other, and *P. lutea* as described by Peck is intermediate between the two. Moreover, specimens of *P. spectabilis* at New York from Bresadola show scarcely a trace of fibrils on the pileus and in stature compare well with our plants. There is a specimen at Albany, from New Brunswick, on birch, that nearly exactly matches Bresadola's specimens.

I must conclude, therefore, that *P. spectabilis* in Europe and America is about equally variable, ranging from medium-sized plants with cylindric or enlarged stems and nearly glabrous to fibrillose-squamulose pileus, to large robust forms with ventricose stems and pileus most often heavily fibrillose and becoming rivulose but sometimes only slightly fibrillose.

37. Pholiota aeruginosa Peck, Rept. N. Y. State Mus. **43:** 35 (81). 1890. Pl. 18.

Pileus 2–10 cm. broad, convex, greenish becoming tinged with yellow or brown, drab to cinnamon or ochraceous-buff in dried specimens, dry, at first glabrous, usually soon more or less areolate with each areola surmounted by one to three fibrillose scales, or sometimes completely squamulose without areolae; flesh with a green tinge, yellowish in dried plants; gills adnate or sinuate-adnate, easily separating, 3–7 mm. broad, pale-ochraceous when young, becoming ochraceous-orange or apricot-buff on drying; veil leaving only a slight fibrous, lacerated annulus, or entirely evanescent; stem central or excentric, equal



Figs. 111–115. *P. aeruginosa:* 111, section of hymenium, × 550; 112, spores, × 550; 113, spores, × 1200. All from Overholts Herb. No. 8081. 114, spores, × 1200 (from type specimens); 115, spores, × 1200 (from Overholts Herb. No. 8773, spores probably less mature).

or nearly so, glabrous or slightly fibrillose, sometimes sulcate-striate, colored like the pileus, solid, 3–8 cm. long, 4–10 mm. thick; spores ellipsoid or elliptic, rarely entirely smooth, typically slightly echinulate when mature, 6–8 × 3.5–4.5 μ; cystidia none.

Habitat: on decaying wood, probably mostly of coniferous trees.

Distribution: specimens have been examined from Trexlertown and Aaronsburg, Pa.; Staten Island, and West Ft. Ann, N. Y.; Womble, Ark.; Priest River, Idaho; Seattle, Wash.

In Peck's herbarium this species is represented by the type specimen from Pennsylvania and a collection from West Ft. Ann., New York. Another Pennsylvania collection is at New York City, by McIlvaine. Dr. Murrill has already referred his *Flammula viridans* from the Pacific Coast to this species. The species seems to be more common westward and exhibits more variation, even in the same collection, as regards scaliness and the areolae on the pileus. The plants described by Harper on Atkinson's determination as *P. Aegerita* belong here, I judge. *Pholiota Aegerita* of Europe is entirely dissimilar in every respect except the areolate pileus. Excellent specimens of that species are at New York collected by Murrill in Europe.

It is difficult to separate this species in most aspects from *Flammula pulchrifolia*, and the writer is of the opinion that they may represent the same plants.

The markings on the spore walls are discernible only under close scrutiny with the high power, but are very evident under the oil-immersion lens, in all but one collection I have examined. In that one they are mostly smooth even with the higher magnification, but a few are distinctly though sparingly roughened (fig. 115).

Pholiota luteofolia is closely related but the present species seems distinct in the green tints of young plants, the areolate pileus of mature ones, and in the more fibrillose scales.

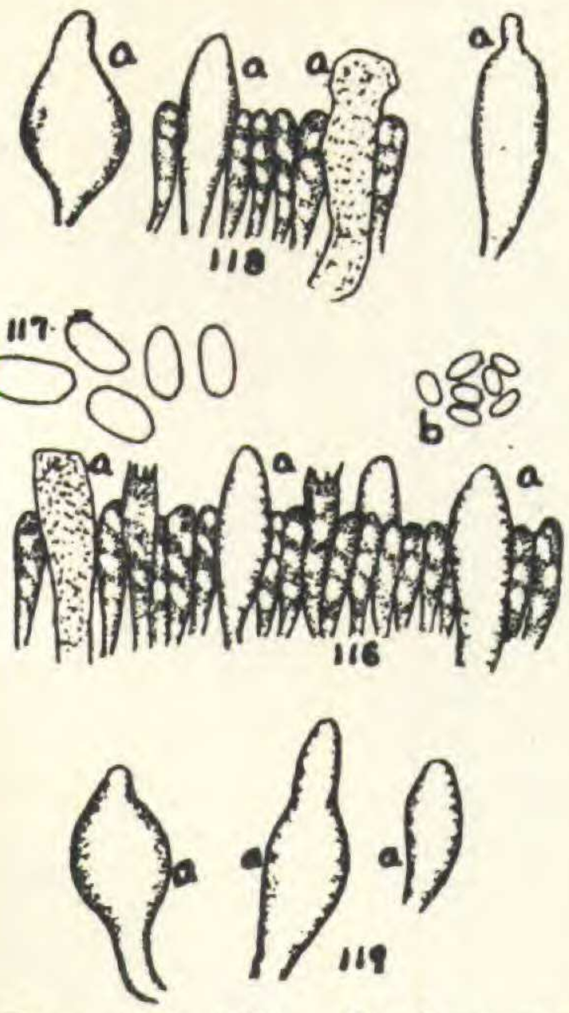
b. Spores smooth.

1. Spores 3.5–5.5 μ long (*see also 2, p. 149*).

38. Pholiota flammans (Batsch) Fries, Syst. Myc. **1**: 244. 1821. Pl. 19.

Agaricus flammans Batsch, Elench. Fung. 30. 1783.

Pileus 2–5 (–8) cm. broad, convex to plane, sometimes umbonate, lemon-yellow or tawny-yellow, zinc-orange or tawny in dried plants, dry, adorned with yellow, superficial, floccose-fibrillose scales that may in large part disappear with age; flesh thin, yellow; gills adnate or very slightly uncinate, medium-close, 2–5 mm. broad, yellow or ferruginous, snuff-brown in dried plants or young specimens may retain their yellow color; veil lemon-yellow, fugacious; stem central, equal, with yellow, recurved, floccose scales, or scarcely more than densely yellow-floccose up to the annulus, stuffed or hollow, yellow, 2–7 cm. long, 2–5 mm. thick; spores oblong, smooth, 3–5.5 × 2–3 μ; cystidia abundant, flask-shaped or clavate-fusoid, brown or hyaline, projecting slightly, 30–40 × 6–12 μ.



Figs. 116–119. *P. flammans:* 116, section of hymenium showing cystidia (a), and spores (b), × 550; 117, spores, × 1200; 118, section of hymenium showing cystidia, and two cystidia isolated, × 550; 119, isolated cystidia, the one on the right hyaline, the other two brown, × 550. All from Overholts Herb. No. 3753.

Habitat: on dead wood of both deciduous and coniferous trees.

Distribution: specimens have been examined from Lake Placid, Osceola, Greig, and Fourth Lake (Herkimer Co.), N. Y.; Glen Brook, Ore.; also reported from Michigan by Kauffman and by Harper.

Illustrations: Fries, Ic. Hym. *pl. 104, f. 1;* Cooke, Ill. Brit. Fungi, *pl. 396 (368)*; Harper, Trans. Wis. Acad. Sci. **17:** *pl. 41C;* Ricken, Blätterpilze, *pl. 55, f. 5.*

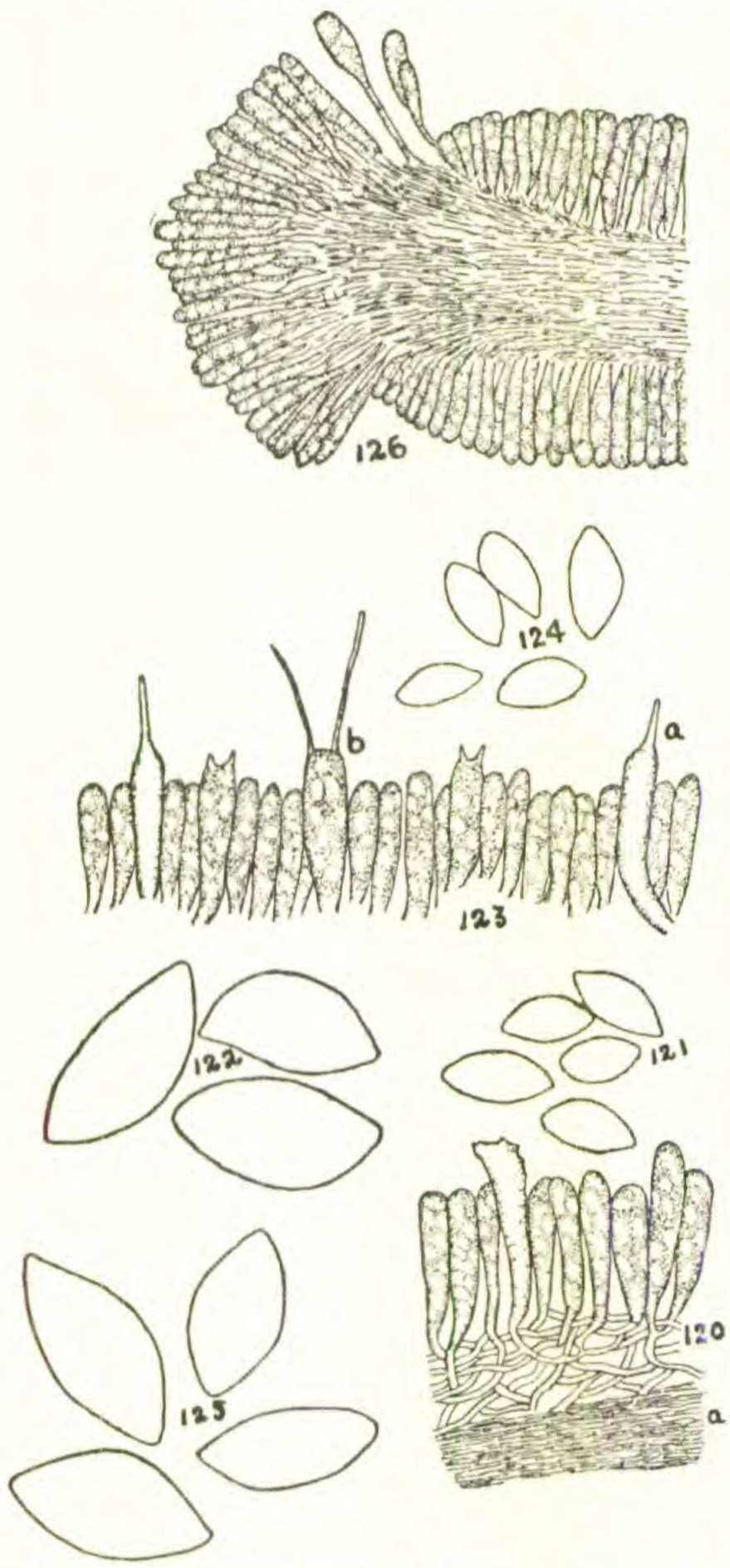
In one collection at New York, from a birch stump, the collector's notes say "viscid."

P. flammans is distinct from all related species in the very small, oblong spores, measuring 3–5 μ long. It is indeed a well-marked species with bright colors and soft floccose scales, and while generally considered as occurring only on coniferous wood, yet a collection at New York is very evidently on the wood of birch. The species is rare, and I have seen no American specimens more than 4 cm. broad.

2. Spores between 9.5 and 15 μ long (*see also 3, p. 152*).

39. Pholiota albocrenulata Peck, Bul. Buffalo Soc. Nat. Sci. **1:** 49. 1873. Pl. 19.

Pileus 2.5–12 cm. broad, conic-campanulate to broadly convex or nearly plane, sometimes umbonate, uniformly yellowish-brown to sayal-brown or tawny, the darker of these colors in dried plants, quite viscid, with rather large scales that are appressed and sub-gelatinous when wet, but become suberect, floccose, and lighter in color on drying, easily separable and sometimes disappearing in old plants; gills sinuate-adnate or slightly decurrent, medium-close or in large specimens rather distant, 3–13 mm. broad, grayish becoming ferruginous, the edge distinctly white-crenulate and remaining so at least in part in dried plants; veil forming a torn fugacious annulus or partly appendiculate to the margin of the pileus; stem central, equal or somewhat enlarged below, sparingly or abundantly squamose with fibrillose scales up to the annulus, pallid or brown below, white and furfuraceous at the apex, 5–11 cm. long, 0.5–2.5 cm. thick; spores broadly-elliptic or fusoid-elliptic, smooth, brown, 11–14 × 6–8 μ; cystidia apparent in fresh specimens as occasional clavate projecting hyaline



Figs. 120–126. *P. albocrenulata:* 120, section of hymenium showing central medulla (a), × 550; 121, spores, × 550; 122, spores, × 1200. All from type specimens. 123, section of hymenium showing the occasional pointed cystidia, × 550; 124, spores, × 550; 125, spores, × 1200; 126, section of edge of gill showing the clavate cells that give to the edge the crenulate appearance, × 550. All from Overholts Herb. No. 9368.

bodies with one or rarely two long slender apical points, rather difficult to locate in sections of dried plants.

Habitat: at base of trees or on prostrate trunks, especially of sugar-maple; one collection said to have been from a hemlock stump.

Distribution: specimens have been examined from Hebron, N. H.; Adirondack Mts. and Lake Pleasant, N. Y.; Cadillac, Mich.; Unaka Springs, Tenn.; Bear Meadows, Center Co., Pa.

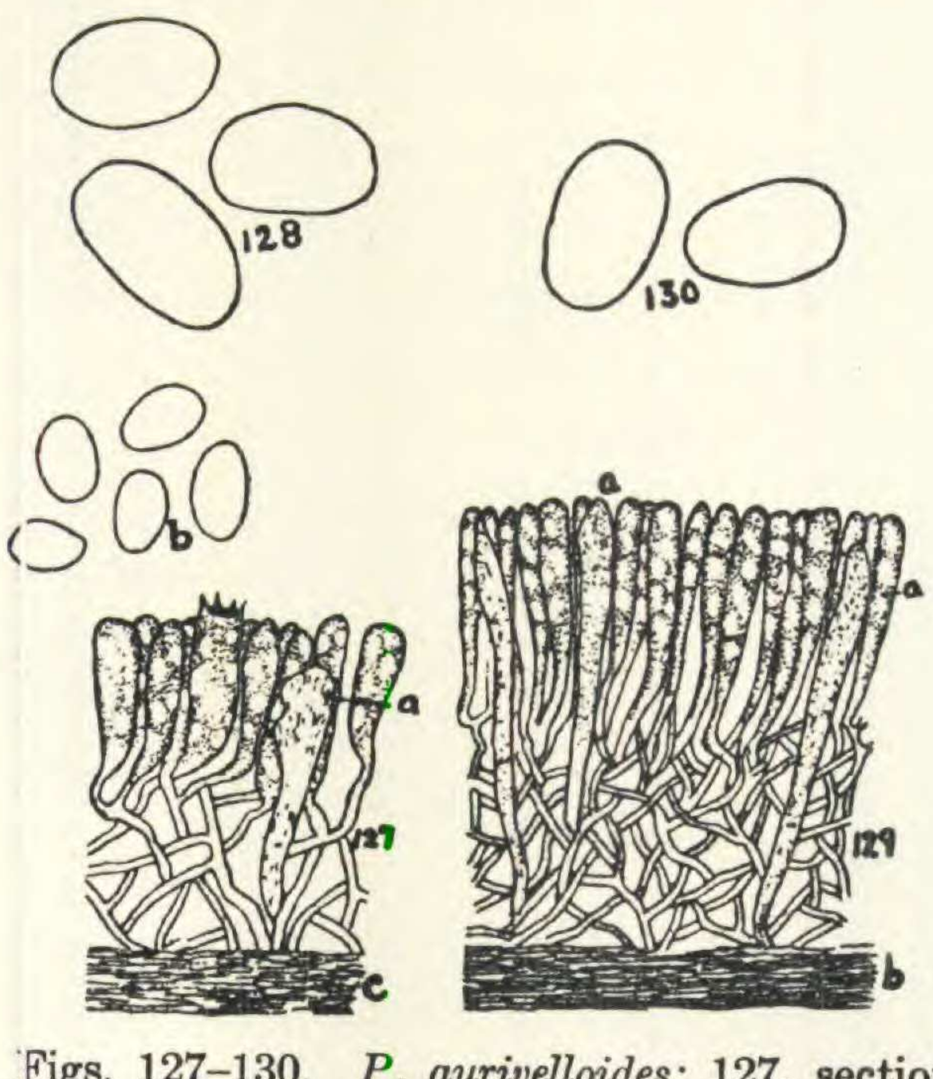
Illustrations: Harper, Trans. Wis. Acad. Sci. **17**: *pl. 42, 43.*

The dark color of the dried pileus recalls *P. aurivella* and the general appearance is similar to that of the European *P. subsquarrosa*. From both of these the species is amply distinct in the large fusoid-elliptic spores. In fact no other similar species of this section, except *P. aurivelloides*, has spores at all comparable in size to these, and in that species they are quite different in shape. The plants usually occur singly. The white crenulations on the edges of the gills are due to the presence there of tufts of radiating clavate cells as shown in my illustration.

In most collections of this species the plants are slender and small in stature, rarely more than 7 cm. broad. Professor Harper illustrates, and I have also found, a large form with pileus 10–12 cm. broad, but otherwise with the characteristics of Peck's types.

40. Pholiota aurivelloides Overholts, sp. nov.

Pileus 5–8 cm. broad, hemispheric or broadly campanulate to convex, ferruginous to tawny, lighter-colored on the margin, sometimes carob-brown in dried plants,



Figs. 127–130. *P. aurivelloides:* 127, section of hymenium showing an imbedded cystidium (a), spores (b), and central medulla (c), × 550; 128, spores, × 1200. All from type specimens. 129, section of hymenium showing imbedded cystidia (a), and central medulla (b), × 550; 130, spores, × 1200. All from specimens in New York State Museum, from New Mexico, by Cockerell.

probably viscid, with a few scattered, spot-like or appressed scales; flesh yellow, rather thick; gills sinuate-adnate or with a decurrent tooth, medium-close or slightly distant, 7–12 mm. broad, whitish then ochraceous-tawny or russet; veil forming a thin, superior, persistent or somewhat evanescent, floccose or submembranous annulus; stem central, equal, yellowish or brownish, more or less scaly, the scales sometimes somewhat gelatinous, solid, 4–8 cm. long, 5–10 mm. thick; spores oblong-ellipsoid, smooth, deep-brown, 9–11 × 6 μ; cystidia numerous or rare, brown, not projecting, 25–35 × 6–8 μ.

Habitat: on dead trees or from wounds in living *Alnus*, *Salix*, or *Betula*.

Distribution: specimens have been examined from Ohio Creek, Colo.; Pecos, N. Mex.; Copperton, Wyo.

The name here used was applied by Peck in his herbarium to the Ohio Creek collection made by Bartholomew, Aug. 24, 1899, and here used as the type collection. It seems sufficiently distinct from *P. aurivella* in the very broad gills and the larger spores that are of a much darker color and with a heavier wall. Their shape is broadly oblong-ellipsoid, while those of *P. aurivella* are narrowly oblong-ellipsoid or ellipsoid. The brown sterile organs in the hymenium are of a somewhat different type also. I have tried to consider these plants as *P. aurivella* but they seem quite different from the plants, various as they are, that have passed under that name.

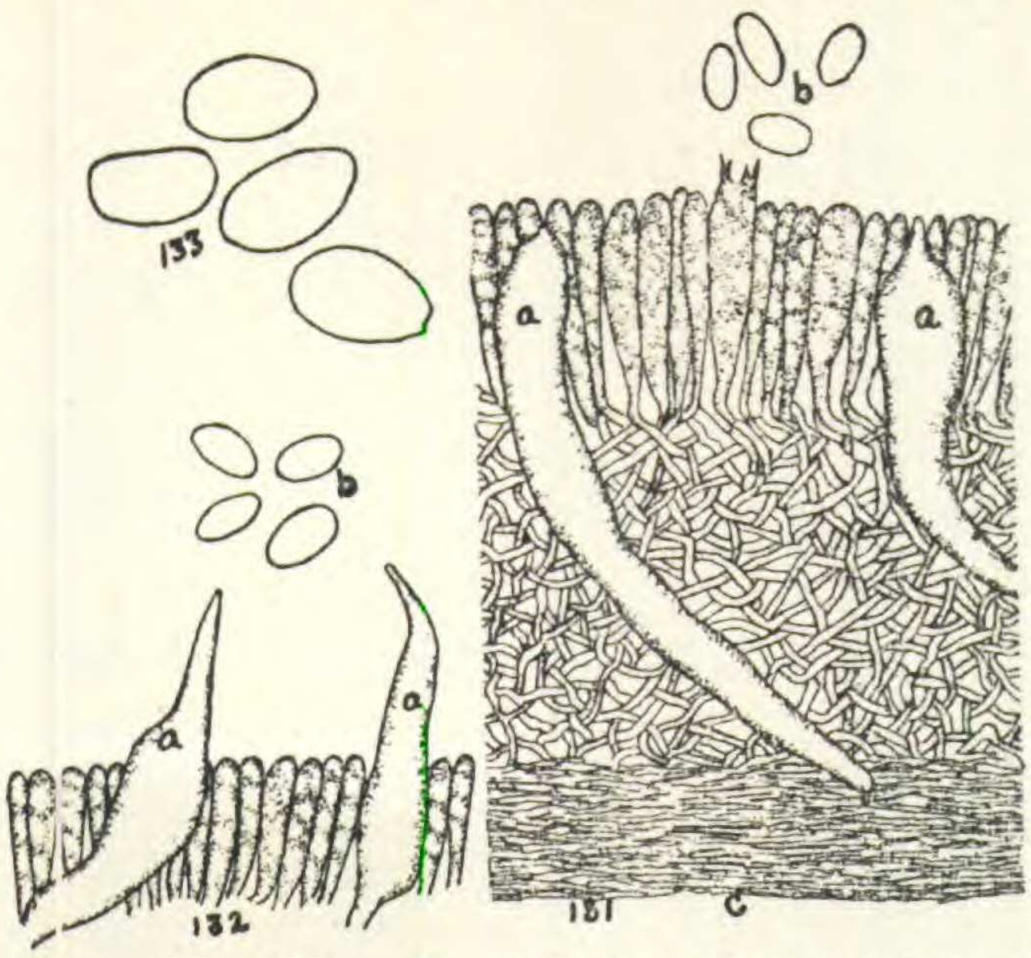
3. Spores 6–9 μ or rarely longer.
aa. Cystidia present and rather conspicuous as brown or hyaline, imbedded or projecting organs (see also bb, p. 159).
aaa. Pileus viscid (see also bbb, p. 156).

41. Pholiota aurivella (Batsch) Fries, Syst. Myc. **1**:242. 1821.
Pl. 24.

Agaricus aurivellus Batsch, Elench. Fung. *f. 115*. 1783.

Pileus 4–13 cm. broad, campanulate to convex, often broadly umbonate, when young more or less uniformly ochraceous-orange to tawny, when mature becoming more uniformly tawny, at first covered with large appressed spot-like scales which may in large part disappear and when wet may become more or less gelatinous, viscid; flesh yellow; gills sinuate-adnate or adnate, close, dark

rusty-brown when mature; veil forming a superior, torn, spore-stained, partly evanescent annulus; stem central or excentric, equal or tapering upward, dry, yellowish or yellowish-brown, floccose above the annulus, fibrillose below and increasingly scaly or shreddy downwards with fibrillose scales that may become recurved, solid, 5–8 cm. long, 5–15 mm. thick; spores exactly and constantly oblong-ellipsoid, smooth, 7–9.5 × 4–5 μ; cystidia present, often rather rare, brown, sometimes projecting and rather conspicuously sharp-pointed, sometimes imbedded and blunt, 6–8 μ in diameter.



Figs. 131–133. *P. aurivella:* 131, section of hymenium showing the imbedded cystidia (a), spores (b), and central medulla (c), × 550; 132, section of hymenium from another gill showing projecting cystidia (a), and spores (b), × 550. All from specimens at New York from Colorado, by Bethel. 133, spores, × 1200, from specimen at New York from Italy by Bresadola.

Habitat: on trunks of living (rarely dead) deciduous or coniferous trees.

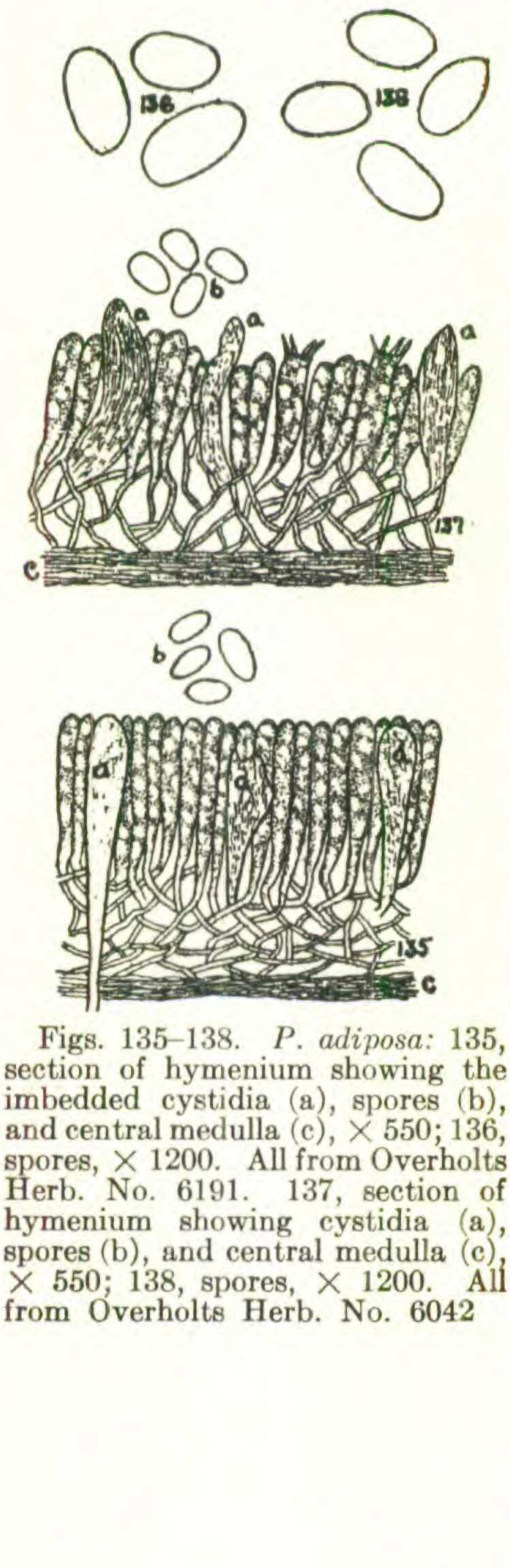
Distribution: specimens have been examined from Colorado; Corvallis, Oregon; San Francisco, Cal.; also reported by Harper from River Forest, Ill.

Illustrations: Batsch, Elench. Fung. *pl. 22, f. 114, 115;* Cooke, Ill. Brit. Fungi, *pl. 390 (351)*; Harper, Trans. Wis. Acad. Sci. **17:** *pl. 38, 39.*

For the distinguishing characters of this species as contrasted with *P. adiposa* see the notes under the latter. The sterile organs in the hymenium of plants referred to this species present wide variations as will be seen from the drawings. In specimens at New York from Bresadola there is an occasional lance-shaped colored organ with much resemblance to the setae of some fungi. In but one American collection have I seen these present—that collected by Gilbert in Oregon, on willow, in 1915. The col-

lection is preserved at New York. Here these seta-like bodies are quite numerous and conspicuous as shown in the illustration. Other collections show a more inconspicuous type of sterile organ and always entirely imbedded. Such collections may represent the type of another species but can scarcely be *P. adiposa*, the most closely related species. The species as here described is admittedly unsatisfactory and consists of collections somewhat similar to *P. adiposa* but yet certainly distinct from it and the next species. Harper's photograph is of particular excellence.

42. Pholiota adiposa Fries, Syst. Myc. **1**: 242. 1821. Pl. 20, 21.



Figs. 135–138. *P. adiposa:* 135, section of hymenium showing the imbedded cystidia (a), spores (b), and central medulla (c), × 550; 136, spores, × 1200. All from Overholts Herb. No. 6191. 137, section of hymenium showing cystidia (a), spores (b), and central medulla (c), × 550; 138, spores, × 1200. All from Overholts Herb. No. 6042

Pileus 3–16 cm. broad, hemispheric to convex or plane, antimony-yellow to zinc-orange or finally the center somewhat tawny, decorated with rather medium-sized squamules of a darker color than the rest of the pileus, and drying down to small dark spots on a tawny base, large thick specimens sometimes areolate in dry weather, in wet weather the pileus occasionally glabrous, all colors well retained in dried plants, viscid or glutinous or dry in dry weather; flesh thin or rather thick, white or light yellow, taste not marked; gills adnate or sinuate-adnate, rather close, 4–10 mm. broad, grayish-brown then yellow or rusty-brown, honey-yellow to tawny in dried specimens; veil yellow, forming a slight, floccose, evanescent annulus; stem central or excentric, terete, equal or nearly so, viscid (dry in dry weather), yellow or tawny, with few or many erect or somewhat recurved yellow or tawny scales, or sometimes only fibrillose, solid or stuffed, rarely

with a small hollow, 4–12 cm. long, 5–20 mm. thick; spores ellipsoid or oblong-ellipsoid, smooth, 7–9(–11) × 4–5 μ; cystidia present, not conspicuous, projecting only slightly if at all, dark brown, clavate, 20–42 × 5–10 μ.

Habitat: stumps and trunks of deciduous trees.

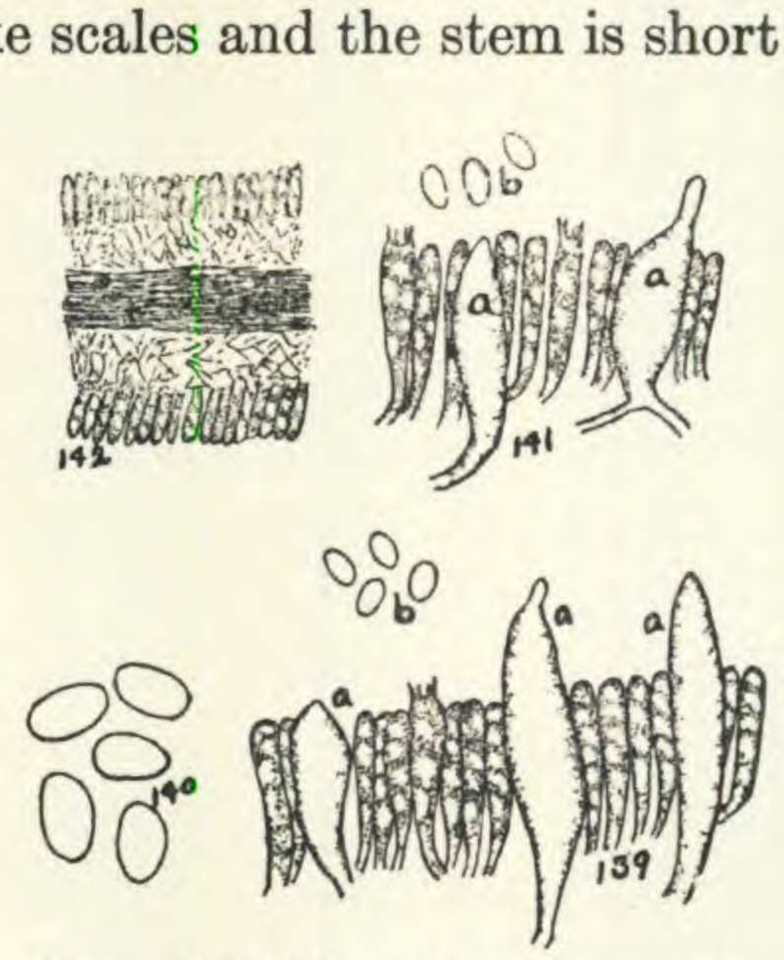
Distribution: specimens have been examined from Cambridge, Mass.; Lake Placid, Bronx Park, and Wells, N. Y.; Forked River, N. J.; State College, Musser Gap, Bear Meadows, and Westport, Pa.; Greencastle and Putnam Co., Ind.; Edgmont and Falling Springs, Ill.; Oxford, Ohio; St. Louis, Mo.; Fort Dodge, Iowa; Plumas Co., Cal.; and Seattle, Wash.

Illustrations: Atkinson, Mushrooms, *pl. 47 (43);* Berkeley, Outl. Brit. Fungi, *pl. 8, f. 2;* Cooke, Ill. Brit. Fungi, *pl. 395 (353)*; Hard, Mushrooms, *f. 211;* Mycologia **1:** *pl. 7, f. 1–2.* 1909; Peck, Rept. N. Y. State Bot **49:** *pl. 46.*

The pileus in both fresh and dried condition is typically golden-yellow or lemon-yellow as contrasted with the prevailing tawny or rusty color of *P. aurivella,* its closest relative. The latter species has larger and more spot-like scales and the stem is short and thick and increasingly scaly downward, while in *P. adiposa* the stem is equally scaly up to the ring or increasingly from the base upward. Ricken states that the stem of *P. aurivella* is not viscid as it is in *P. adiposa.*

43. Pholiota squarrosoides Peck, Rept. N. Y. State Mus. **31:** 33. 1879. Pl. 22.

Pileus 2.5–10 cm. broad, subglobose to convex or nearly plane, light-colored, typically cinnamon-buff or cinnamon in dried plants, viscid, covered with erect, pointed, cinnamon or tawny scales that give color to the pileus, sometimes disappearing on the



Figs. 139–142. *P. squarrosoides:* 139, section of hymenium showing cystidia (a), and spores (b), × 550; 140, spores, × 1200. All from Overholts Herb. No. 3770. 141, section of hymenium showing cystidia (a), and spores (b), × 550; 142, section of hymenium showing central medulla tissue, × 550. All from type specimens.

margin; flesh white or slightly yellowish, gills sinuate-adnate, medium-close, 4–7 mm. broad, whitish becoming brownish-ferruginous, cinnamon or ochraceous-tawny in dried plants; veil forming a floccose, persistent or evanescent annulus; stem central, equal, brownish and with recurved light cinnamon or tawny scales below the annulus, white and smooth above, solid or stuffed, 5–15 cm. long, 5–12 mm. thick; spores ellipsoid or oblong-ellipsoid, smooth, 4–6 × 3–4 μ; cystidia present, variable, of two general types: (a) hyaline, pointed at the apex, projecting slightly, and (b) brown, obtuse or pointed, sometimes projecting, both types measuring 25–35 × 8–12 μ.

Habitat: on stumps and trunks of deciduous trees.

Distribution: specimens have been examined from Maine; Redding, Conn.; Vaughns, Catskill Mts., Canandaigua, and North Elba, N. Y.; Bear Meadows, Pa.; also reported from Michigan by Harper and by Kauffman.

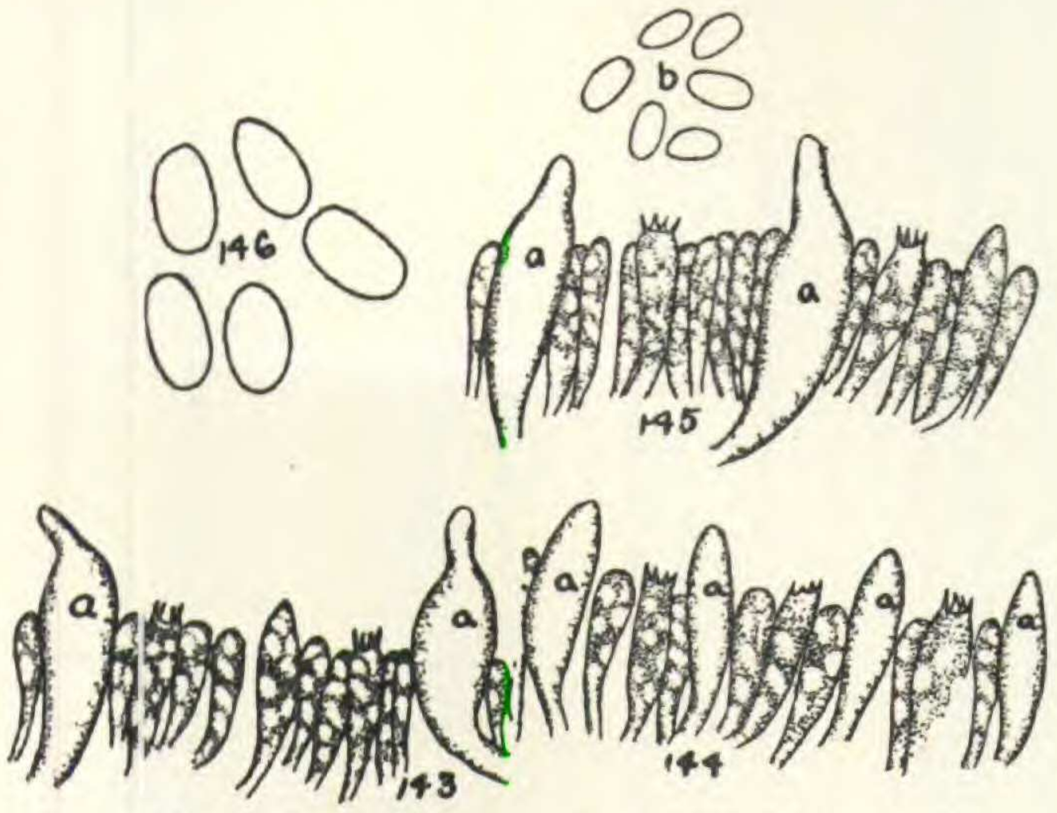
Illustrations: Hard, Mushrooms, *f. 216;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 36, 37;* Peck, Ann. Rept. N. Y. State Mus. **54:** *pl. 73, f. 6–14;* White, Hymen. Conn. *pl. 21.*

The scales on the pileus appear floccose under a lens, but they are rather harsh to the touch in dried plants. In young plants they appear more or less erect, particularly over the center of the pileus, but on the margin they may be only recurved or in dried plants practically appressed. From *P. squarrosa* the species differs in the viscid pileus, the smaller size, the more cespitose habit, the squarrose center of the more highly scaly pileus, and the smaller spores. The spore difference seems insignificant as here stated but when spores of the two species are compared side by side under the microscope it is very striking. Only rarely do the spores of *P. squarrosoides* reach a length of 6 μ, the wall is thin, and the shape more apt to be broadly ellipsoid, while in *P. squarrosa*, 6 μ is about the minimum length, the spore wall is heavier or darker, and the shape more oblong-ellipsoid. The cystidia are very comparable in the two species. Small specimens that have become tawny in drying have a strong resemblance to specimens of *P. subsquarrosa* at New York from Bresadola, and microscopically the two are quite similar.

bbb. Pileus dry.

44. Pholiota squarrosa Fries, Syst. Myc. **1:** 243. 1821. Pl. 21.

Pileus 3–10 cm. broad, campanulate to convex or plane, yellowish or yellowish-brown, antimony-yellow to tawny in dried specimens, covered with rather large, recurved, tawny or yellowish scales, dry; flesh yellowish, taste mild; gills sinuate-adnate and often somewhat decurrent, medium-close, 3–6 mm. broad, pallid then ferruginous, in dried plants varying from honey-yellow to tawny-olive or tawny; veil forming a thick, persistent, floccose annulus often striate on the upper surface; stem central, equal, pallid, yellow or brown, with conspicuous recurved scales up to the annulus, solid, 5–12 cm. long, 5–12 mm. thick; spores oblong or ellipsoid, smooth, 6–8 × 3.5–4.5 μ; cystidia present, variable, of two general types: (a) hyaline, abundant, pointed at the apex, projecting, and (b) brown, blunt or truncate at the apex, mostly projecting, both types 25–35 × 7–14 μ.



Figs. 143–146. *P. squarrosa:* 143–145, sections of three gills from same plant showing various forms of cystidia (a), and spores (b), × 550; 146, spores, × 1200. All from Overholts Herb. No. 8058.

Habitat: on dead trunks or stumps of various trees, both deciduous and evergreen.

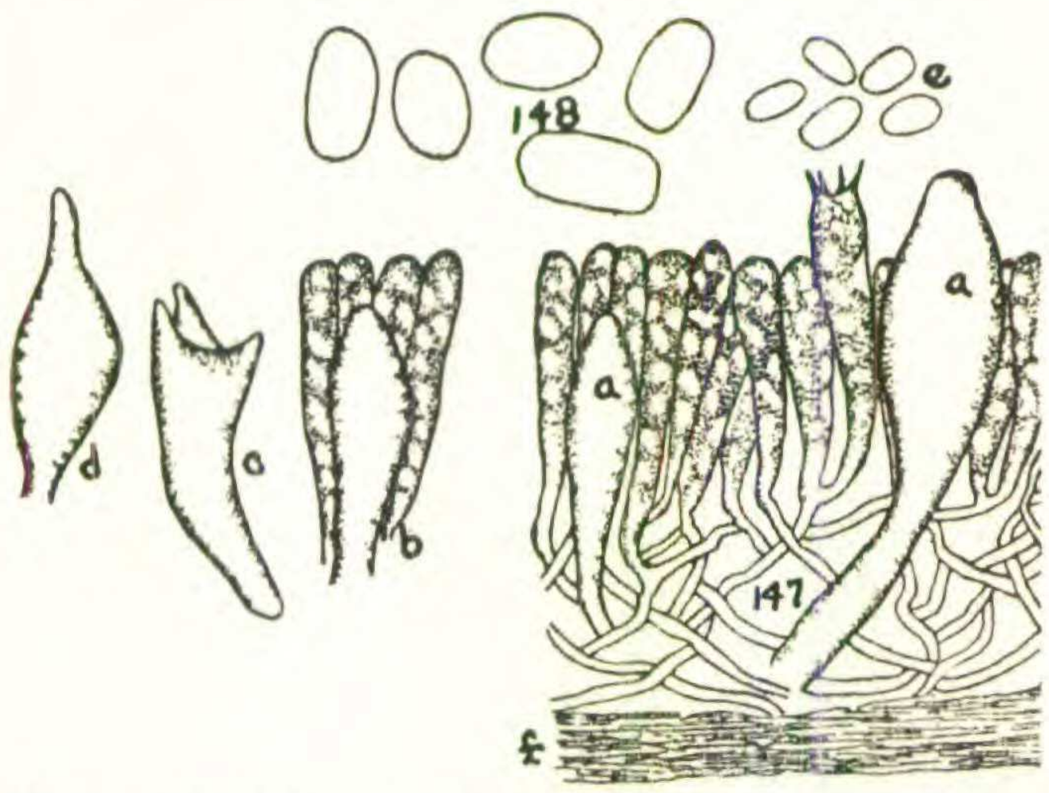
Distribution: specimens have been examined from Piscataquis Co., Me.; Stocktenridge, Mass.; Yama Farms and North Elba, N. Y.; Washington, D. C.; State College, Pa.; Jack Brook, Colo.; also reported from Michigan and Wisconsin by Harper.

Illustrations: Bernard, Champ. Roch. *pl. 19, f. 1;* Cooke, Ill. Brit. Fungi, *pl. 391 (367);* Hard, Mushrooms, *f. 217;* Hussey, Ill. Brit. Myc. **1:** *pl. 8;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 35;* Patouillard, Tab. Anal. Fung. *f. 340;* Peck, Rept. N. Y. State Mus. **55:** *pl. 79, f. 1–7.*

For detailed data as to the differences between *P. squarrosa* and *P. squarrosoides,* see the latter species.

45. Pholiota rigidipes Peck, Bul. N. Y. State Mus. 157: 31. 1912.

Pileus 4–8 cm. broad, broadly convex, sometimes slightly or broadly umbonate, pale yellow or buff, buff-yellow to ochraceous-buff or ochraceous-orange in dried plants, squamulose with scattered, appressed, slightly darker-colored, fibrillose scales that are more prominent in the center though never conspicuous and partially disappear in mature plants, dry; flesh white, tinged yellow next the gills, distinctly yellow in dried plants; taste mild; gills sinuate-adnate or adnate, medium-close, 3–7 mm. broad, cinnamon or ochraceous-tawny and retaining these colors in drying; veil forming a slight, often evanescent annulus; stem central, equal, pallid or yellowish and fibrillose-squamulose or becoming nearly glabrous below the annulus, white and pruinose at the top, stuffed or hollow, 5–9 cm. long, 4–6 mm. thick; spores oblong or oblong-ellipsoid, smooth, 6.5–8.5 × 3.5–4.5 μ; cystidia present, not always abundant, brown, some projecting, 25–40 × 6–8 μ.



Figs. 147–148. *P. rigidipes:* 147, section of hymenium showing cystidia (a) and spores (e), and central medulla (f), × 550; 148, spores, × 1200. All from type specimens.

Habitat: in woods, probably always on buried or exposed wood.

Distribution: specimens have been examined from Constableville and Utica, N. Y.; Forked River, N. J.; Creve Coeur Lake, Mo.

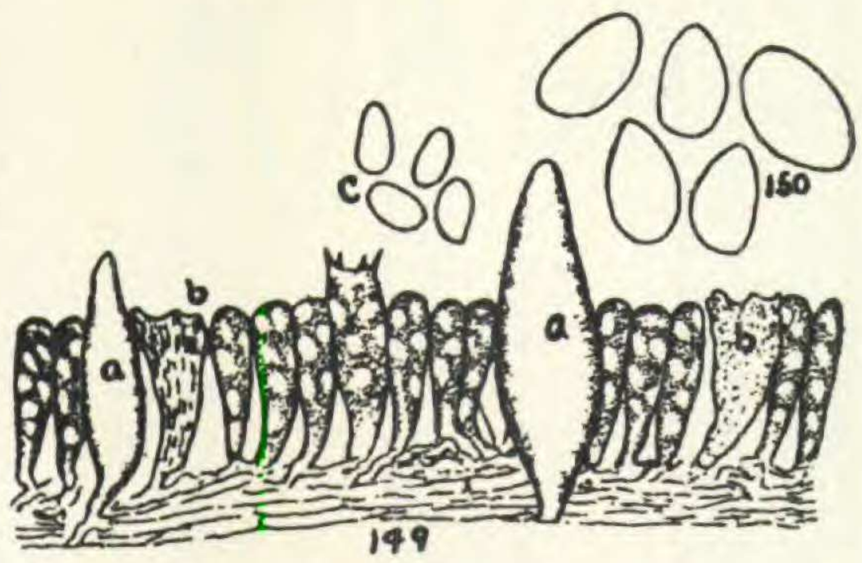
The species is well represented at Albany by the type collection which shows it to be a medium-sized plant with sparsely scaly pileus and fibrillose-scaly slender stem of the *P. adiposa* group. In spite of Peck's original note that it occurs on the ground among fallen leaves, I am of the opinion that it must have been attached to wood, perhaps buried wood. The aspect is much like that of

a *Flammula*. A second collection, perhaps referable here, is labeled *P. terrigena* and was collected by Atkinson, October, 1902. This collection has dirt attached to the basal part of the stem, but may have been also from buried wood. In both collections the flesh is distinctly yellow, close to lemon-yellow. The plant is not at all related to *P. angustipes*, as the scales are larger, more fibrillose, and scattered, and the colors are distinctly brighter.

46. Pholiota Schraderi (Peck) Overholts, N. Am. Fl. **10:** 271. 1924.

Stropharia Schraderi Peck, Bull. Torr. Bot. Club **32:** 80. 1905.

Pileus 5–8 cm. broad, convex to nearly plane, pallid when young, ochraceous-buff when mature, dry, fibrillose, squamulose, or rimose-squamulose on the disk; context white, with taste of radishes; lamellae adnate, close, thin, whitish then brown; annulus small, lacerate, white, sometimes evanescent; stem central, subequal, squamulose and concolorous with the pileus below, white and mealy above, solid, 2–4 cm. long, 8–12 mm. thick; spores ovoid, not apiculate, smooth, 6–8(–9) × 4–6 μ; cystidia rather abundant, hyaline, fusoid, projecting rather prominently; also irregular organs as though post-mature basidia imbedded in the hymenium.



Figs. 149–150. *P. Schraderi:* 149, section of hymenium showing cystidia (a–b), and spores (c), × 550; 150, spores, × 1200. All from type specimens.

Habitat: in sandy soil about stumps.

Distribution: known only from the type locality, Washington, D. C.

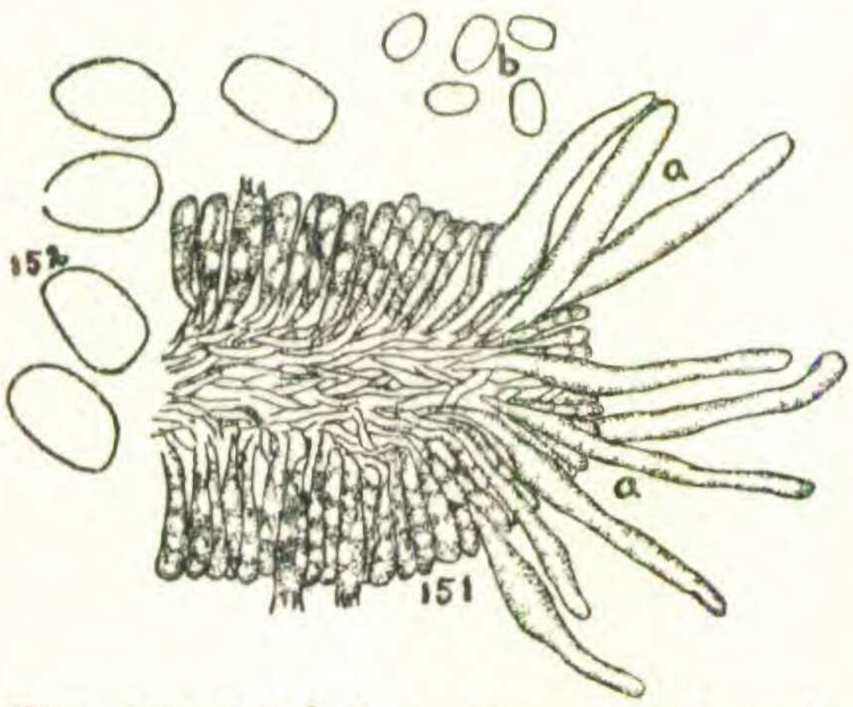
The plants are considerably like *P. fulvo-squamosa* but the stem is less prominently scaly, the spores are not at all apiculate, and cystidia are rather abundant and conspicuous. From *P. spectabilis* it differs in the smooth spores and the cystidia.

bb. Cystidia none.

aaa. Pileus 1–3 cm. in diameter (*see also bbb, p. 162*).

47. Pholiota confragosa Fries, Epicr. Syst. Myc. 169. 1836–38. Pl. 22, 23.

Pileus 1–2.5 cm. broad, convex to nearly plane, cinnamon-rufous when moist, tawny when dry, nearly uniform warm-buff or cinnamon-buff in dried plants, densely and finely floccose-squamulose or floccose-fibrillose under a lens, in age becoming somewhat denuded at times but never entirely so, hygrophanous, margin striate when moist; context fleshy-fragile, pallid, odor and taste not marked; gills adnate or slightly decurrent, sometimes white-crenulate on the edge, medium-close, 1–3 mm. broad, rufous to cinnamon-brown; veil forming a superior, membranous annulus, erect and sub-rigid for a time, finally more annulate and in rare cases all but disappearing; stem central, equal or enlarged just at base, concolorous with the pileus or paler, markedly fibrillose below the annulus and sometimes white-tomentose or strigose at the base, floccose and sometimes striate above, 2–5 cm. long, 1.5–5 mm. thick; spores ellipsoid or broadly ellipsoid, smooth, not truncate, dilutely colored under the microscope, 6–8 × 4–5 μ; cystidia none except for radiating tufts on the edge of the gill.



Figs. 151–152. *P. confragosa:* 151, section of edge of a gill showing the clavate or lance-shaped sterile cells (a), and spores (b), × 550; 152, spores, × 1200. All from Overholts Herb. No. 8061.

Habitat: rotten mossy trunks of deciduous trees.

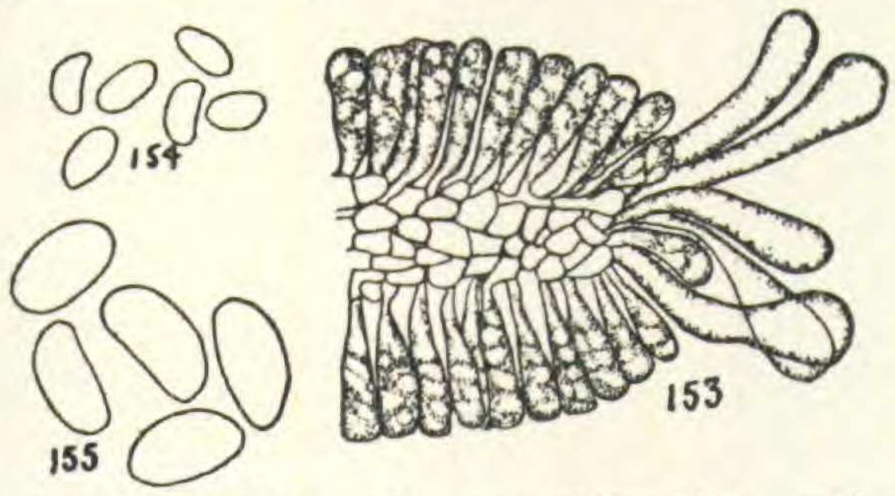
Distribution: specimens have been examined from Sebec Lake, Me.; Mt. Mansfield, Vt.; Stockbridge, Mass.; Lake Placid, Adirondack Mts., and Fourth Lake (Herkimer Co.), N. Y.; also reported from Michigan by both Harper and Kauffman.

Illustrations: Fries, Ic. Hym. *pl. 105, f. 2;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 41, f. D, E.*

When once learned this species is among the easiest to recognize by the peculiar constant color, especially of dried plants, and the matted fibers on the pileus, resembling as seen under a lens, the pileus fibers in *P. caperata* or *P. comosa* as seen without a lens.

48. Pholiota erinaceella Peck, Rept. N. Y. State Mus. **30:** 70. 1878.

Pileus 0.5–2.5 cm. broad, hemispheric then convex or nearly plane, tawny-brown, not changing color in drying, dry, densely covered with minute, erect, pyramidal, spine-like, or granular, tawny scales; gills adnexed or adnate, medium-close or subdistant when young, 1–2 mm. broad, pallid then cinnamon-brown; veil forming a slight, superior, floccose, evanescent annulus; stem central, equal, tawny, with numerous floccose scales or granules below the annulus, smooth above, stuffed or hollow, 1.5–2.5 cm. long, 1–1.5 mm. thick; spores ellipsoid or naviculoid, smooth, very dilute brown under the microscope, 6–8 × 4–5 μ; cystidia none on the sides of the gills, protruding abundantly from the edge of the gills.



Figs. 153–155. *P. erinaceella:* 153, section of edge of gills showing clavate sterile cells, × 550; 154, spores, × 550; 155, spores, × 1200. All from Overholts Herb. No. 3751.

Habitat: on dead wood of deciduous trees.

Distribution: specimens have been examined from Lake Pleasant and Boreas, N. Y.; St. Louis, Mo.; also reported by Harper from Michigan.

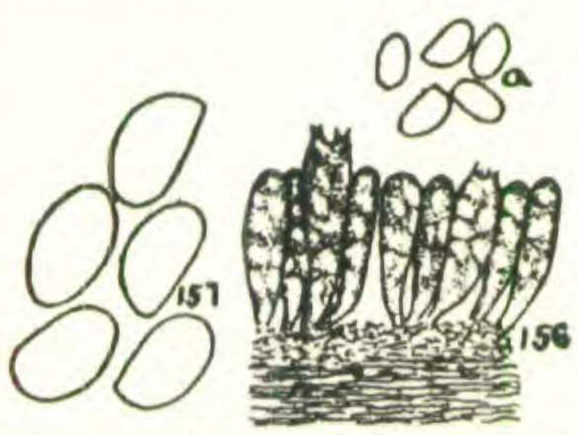
Illustrations: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 51.*

The species is well marked by the small stature, the covering of spine-like scales on both pileus and stem, and the tufts of cystidia on the edges of the gills. *Agaricus* (*Pholiota*) *detersibilis* Peck is a synonym.

49. Pholiota muricata Fries, Syst. Myc. **1:** 244. 1821. Pl. 14.

Pileus 1–3 cm. broad, convex to plane, obtuse or often slightly umbilicate-depressed, golden-brown or tawny-yellowish when fresh, brown or cinnamon-brown in dried plants, covered by a dense cuticle of short tawny fibrils or fibrillose-tufted scales, or granulose-squarrose at the center, dry; flesh thin, yellowish, taste none, odor mild; gills sinuate-adnate, often nearly free in age, medium-close or slightly distant, light yellow then cinnamon-brown or rusty-brown, the edge white-crenate, 3–4 mm. broad;

veil forming an indistinct superior evanescent annulus; stem central, equal, yellowish but with few, rusty-brown, fibrillose, sub-erect scales or becoming nearly glabrous, stuffed then hollow, 3–7 cm. long, 2–5 mm. thick, sometimes with a bright yellow mycelium at the base; spores ellipsoid, smooth, 6–8 × 3.5–4 μ; cystidia none.



Figs. 156–157. *P. muricata:* 156, section of hymenium showing spores (a), × 550; 157, spores, × 1200. All from specimen at New York from Michigan.

Habitat: on rotting logs of deciduous trees.

Distribution: specimens have been examined from Ann Arbor, Michigan; also reported from Illinois by Harper.

Illustrations: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 52, 53.*

The species as here understood is based on plants collected by Kauffman in Michigan. There is a resemblance to *P. curvipes* but the colors are not so bright and the gills in particular are not bright ochraceous-orange as in that species. The scales on the pileus are also different. *P. erinaceella* may not be distinct but is a smaller plant, with more spine-like scales and more brown in color.

bbb. Pileus 2.5–7 cm. broad.

50. Pholiota lucifera (Lasch) Fries, Epicr. Syst. Myc. 167. 1836–38.

Agaricus luciferus Lasch, Linnaea **3:** 408. 1828.

Pileus 2–5 cm. broad, convex or plane, uniformly yellow, ochraceous-buff or ochraceous-orange in dried plants or the center more tawny, viscid, decorated with small yellowish or tawny squamules; flesh yellow; gills adnate, close, 2–4 mm. broad, yellow then bright rusty-brown, white-crenulate on the edge when young; veil forming a superior evanescent annulus; stem central, equal or slightly thickened at the base, solid, yel-

Figs. 158–159. *P. lucifera:* 158, section of hymenium with spores (a), × 550; 159, spores, × 1200. All from specimens at New York from Bresadola.

lowish above, brownish below, peronate-fibrillose, 2–5 cm. long, 3–8 mm. thick; spores oblong-ellipsoid or bean-shaped, smooth, 7–9 × 4–5 μ; cystidia none.

Habitat: on dead trunks and limbs.

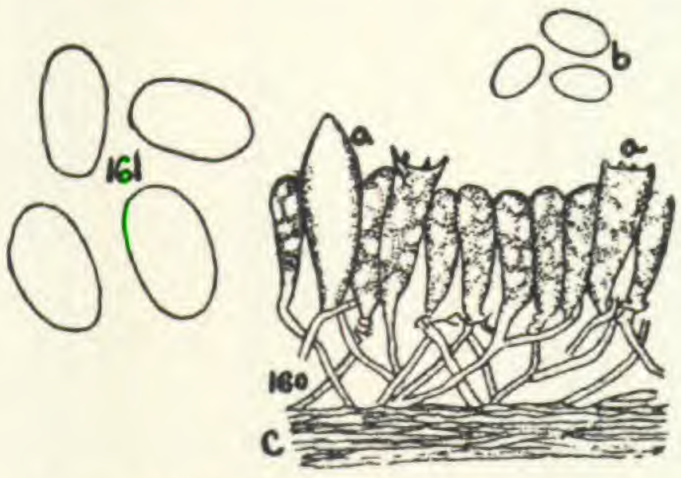
Distribution: reported by Kauffman from Michigan.

Illustrations: Bresadola, Fung. Trid. **1:** *pl. 85;* Ricken, Blätterp. *pl. 54, f. 1.*

European authors agree in describing the plant as with a peronate stem, i.e., with a distinct sheath that is at first continuous as the veil over the pileus. Bresadola represents it as somewhat glutinous or at least forming glutinous scales. In this character it seems to be different from *P. limonella.* I have seen no American specimens of this plant.

51. Pholiota limonella Peck, Rept. N. Y. State Mus. **31:** 33. 1879.

Pileus 2.5–5 cm. broad, convex or nearly plane, sometimes umbonate, lemon-yellow when fresh, retaining the color in the dried plants or becoming slightly tawny, with scattered, reflexed or suberect, fibrillose, reddish or tawny scales, viscid; flesh thin, yellow; gills sinuate-adnate or slightly adnexed, close, 2–4 mm. broad, whitish, becoming ferruginous, honey-yellow or cinnamon-buff in dried plants; veil forming a floccose, evanescent, yellow annulus; stem central, equal, yellowish, with scattered recurved yellow scales, smooth above the annulus, solid, 3–7 cm. long, 3–5 mm. thick; spores ellipsoid or ovoid, smooth, deep brown, 6.5–7.5 × 4.5–5 μ; cystidia none; trama with a distinct central medulla.



Figs. 160–161. *P. limonella:* 160, section of hymenium showing cystidia (a), spores (b), and central medulla (c), × 550; 161, spores, × 1200. All from type specimens.

Habitat: prostrate trunks of beech and birch.

Distribution: specimens have been examined only from Griffins, N. Y.

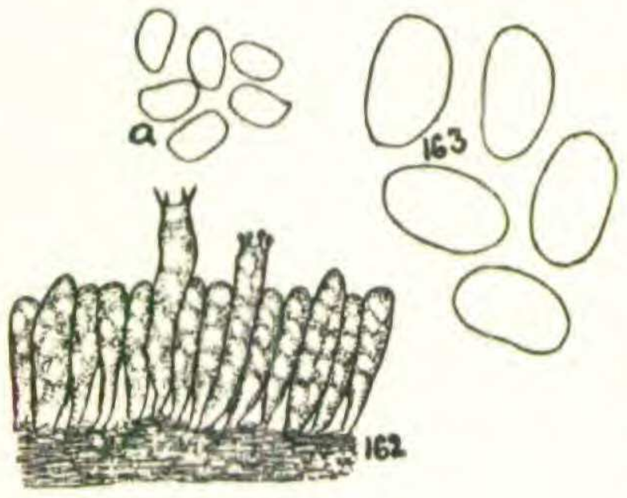
Although this species might be compared to *P. flammans* yet the colors are different, the spores are larger, sterile organs are absent from the hymenium, and the plant lacks the yellow pulverulent

appearance of dried plants of that species. It may not be distinct from *P. lucifera*.

52. Pholiota tuberculosa Fries, Syst. Myc. **1:** 244. 1821.

Pl. 14.

Pileus 2–6 cm. broad, convex to plane, rarely depressed, obtuse, more or less ochraceous-orange, ochraceous-tawny in herbarium specimens, dry, glabrous when young, soon breaking up into appressed or erect innate squamules; flesh yellow, thin, taste mild, odor none; gills emarginate or becoming free, broad, yellow then tawny, the edge serrate; veil forming a superior, often evanescent annulus; stem central, with a prominent bulb just at base and rooting below, fibrillose or slightly scaly, incurved, hollow, yellowish, 1.5–3 cm. long, 1–5 mm. thick; spores ellipsoid or oblong-ellipsoid, smooth, 6–8.5 × 4–5 μ; cystidia none.



Figs. 162–163. *P. tuberculosa:* 162, section of hymenium with spores (a), × 550; 163, spores, × 1200. All from specimens at New York from Europe by Bresadola.

Habitat: on dead wood of deciduous trees.

Distribution: reported by Harper from Michigan.

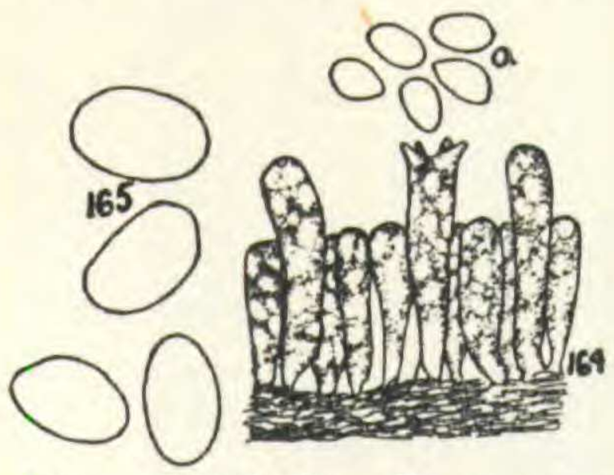
Illustrations: Cooke, Ill. Brit. Fung. *pl. 398a (370)*; Fries, Ic. Hym. *pl. 104, f. 2;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 41, A, B.*

I have seen no plants referable to this species. Harper's specimens seem to meet the requirements, although the spore measurements (3 × 5–6 μ) are somewhat smaller than I find in European plants.

53. Pholiota curvipes Fr. Epicr. Syst. Myc. 168. 1836–38.

Pileus 2–5 cm. broad, convex to plane, ochraceous-orange, more tawny in age and in herbarium specimens, at first innately floccose or densely silky-floccose, in age breaking up into small fibrillose scales, even, dry; margin even, sometimes appendiculate from the veil; flesh yellow, thin, taste mild, odor none; gills adnate, medium-close to slightly distant, bright ochraceous-orange when mature and in dried specimens, the edge white or

yellow, conspicuously floccose-crenate, 3–6 mm. broad; veil forming a superior, soon evanescent, radiate-floccose annulus, or annulus none; stem central, equal or tapering upward, ochraceous-orange or ochraceous-tawny, clear yellow at apex, decidedly floccose-fibrillose, hollow, 2–5 cm. long, 2–5 mm. thick; spores ellipsoid or oblong-ellipsoid, smooth, 7–8.5 × 4–5 μ; cystidia none.



Figs. 164–165. *P. curvipes:* 164, section of hymenium with spores (a), × 550; 165, spores, × 1200. All from specimen at New York from Sebec Lake, Maine.

Habitat: on dead wood of deciduous trees.

Distribution: specimens have been examined from Sebec Lake, Me.; Osceola, N. Y.; and Creve Coeur, Mo.; also reported from Ann Arbor, Mich., by Kauffman.

Illustrations: Fries, Ic. Hym. *pl. 104, f. 3;* Cooke, Ill. Brit. Fungi, *pl. 398 (370) b.*

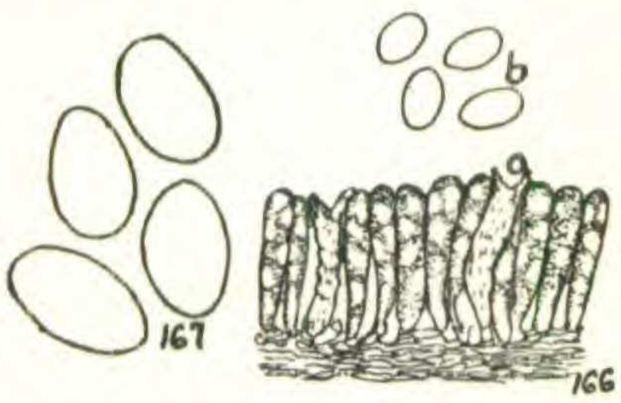
Among the similar-appearing species in the genus *Flammula* and the related species in *Pholiota* it is extremely difficult to set up specific limitations that will hold. Kauffman seems certainly to have had my plant, although descriptions are hardly adequate for the determination of species in this group. In the several hundred collections of *Pholiota* at the New York Botanical Garden I found but one that I think is undoubtedly this species as illustrated by Fries. Burt has made two collections in Missouri that agree in all respects with my conception of this species. The cap is nearly uniformly ochraceous-orange, the gills of about the same color near the margin of the pileus, but darker and more sordid toward the stem, and the stem is practically concolorous *throughout* with the pileus. In the dried plant the scales on the pileus are appressed and very slightly darker than the cuticle. Another collection agreeing even more closely with Fries' illustration is in the herbarium at Albany and a portion in the writer's herbarium. It was collected in New York by Peck. While the colors here would indicate a relationship with *P. limonella*, yet the stem there is distinctly clothed with recurved floccose scales and the gills are more sinuate or even adnexed as they are also in *P. flammans*, which species differs further in having much smaller spores. The

affinities of the species appear to me to be more with these enumerated than with *P. muricata* and *P. erinaceella*. *P. lucifera* seems to differ in having a lemon-yellow viscid pileus and a scaly stem. It is reported on the wood of coniferous trees.

Without seeing the plants described and figured under this name by Harper I cannot admit their identity. The scales and the gills are both described as tawny while in my plants they are much brighter in color.

54. Pholiota angustipes Peck, Rept. N. Y. State Mus. **30:** 40. 1878. Pl. 23.

Plants cespitose, 2.5–7 cm. broad, hemispheric becoming convex or nearly plane, brown or grayish-brown, becoming ochraceous-brown or subalutaceous, drying between avellaneous and cinnamon-buff or somewhat ochraceous-tawny, slightly viscid when moist, squamulose with minute, dot-like appressed scales; context fleshy, thin, yellowish or whitish, taste unpleasant; gills sinuate-adnate to adnate or slightly decurrent, medium-close, 3–6 mm. broad, whitish or creamy-yellow, becoming tawny-brown, but cinnamon-buff or cinnamon in dried plants; veil forming a slight, usually evanescent annulus; stem central, equal or tapering downward, whitish to avellaneous, slightly squamose or fibrillose, stuffed or hollow, 3–7.5 cm. long, 4–12 mm. thick; spores ellipsoid, smooth, dilute-brown under the microscope, 6–8 × 3–5 μ; cystidia none or scarcely noteworthy as small collapsed basidium-like bodies, brown in color, and occurring with the basidia.



Figs. 166–167. *P. angustipes:* 166, section of hymenium with the inconspicuous sterile cells (a), and spores (b), × 550; 167, spores, × 1200. All from type specimens.

Habitat: in pastures or open woods, commonly near or around old stumps.

Distribution: specimens have been examined from Schenevus, Staten Island, and Menands, N. Y.; West Elkton, Ohio; also reported by Harper from Madison, Wis.

Illustration: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 34.*

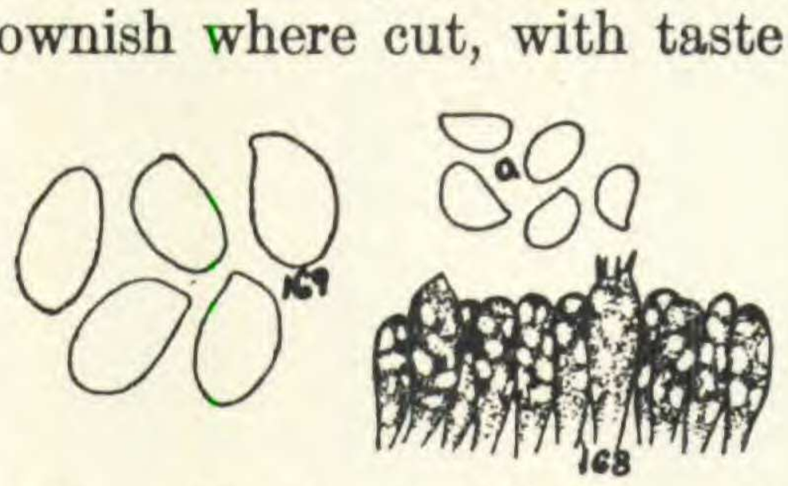
The species is a well-marked one in the pallid to brown color-

ation and the minute scales that thickly cover the pileus and to the unaided eye give the appearance of small dots. Yet in one ample collection from Ohio some specimens are decidedly squamulose, while other younger ones are entirely glabrous. This same collection has a reddish hue to the center of the pileus that is not mentioned in the notes on the fresh specimens. The sterile organs in the hymenium are quite inconspicuous but show up much more strongly when the sections are cleared in glycerine. No distinct annulus is formed and the species may fit better in *Flammula* than in *Pholiota*. Harper's photograph is excellent, showing extremely well the dot-like scales on the pileus.

ccc. Pileus 6–15 cm. in diameter.

55. Pholiota fulvo-squamosa Peck, Bul. Torr. Bot. Club **30:** 95. 1903. Pl. 13.

Pileus fleshy, 6–12 cm. broad, rather thin, convex becoming nearly plane, dry, covered with a tawny fibrous cuticle of brownish fibrillose scales, the lighter-colored flesh showing up when the fibers separate into scales, sometimes concentrically cracked about the disk; flesh white, becoming brownish where cut, with taste and odor of radishes; gills rather narrow, close, adnate or joined to a slight collar around the stem, whitish becoming pinkish-cinnamon then dark cinnamon with a white-crenulate edge; annulus ample, membranous, persistent, scaly below, the upper surface striate; stem central, equal, stuffed or hollow, covered below the ring with numerous, erect, subfloccose, tawny scales, slightly floccose above the annulus, 5–8 cm. long, 8–10 mm. thick; spores elliptic or ellipsoid, rather strongly apiculate at the base, dark ferruginous-brown, smooth, 6–8 × 3.5–4.5 μ; cystidia none or not noteworthy.



Figs. 168–169. *P. fulvo-squamosa:* 168, section of hymenium with spores (a), × 550; 169, spores, × 1200. All from Overholts Herb. No. 934.

Habitat: about the bases of trees or attached to buried wood.

Distribution: Michigan.

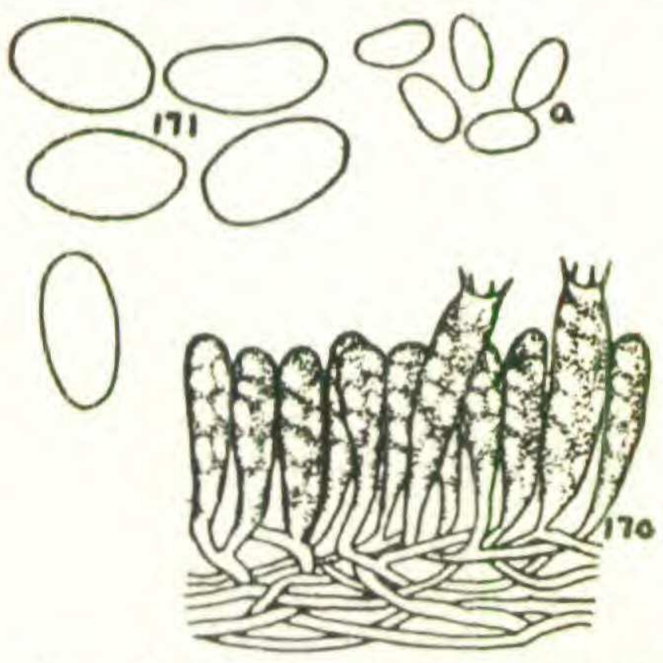
Illustration: Harper, Trans. Wis. Acad. Sci. **17:** *pl. 60.*

I have seen no specimens of this plant other than the type at

Albany. At first glance the dried plant looks much like an *Agaricus*, similar to *A. subrufescens*. The gills are quite narrow as in *P. duroides*. The spores are quite dark and very similar to those of *Agaricus* but no *Agaricus* has so pronounced a scaliness on the stem. Harper notes the absence of the radish odor and the color change of the flesh and gives excellent figures of the plant.

56. Pholiota destruens Brond. Plant Crypt. de l'Agen, *pl. 6*. 1828–30.

Pileus 6–15 cm. broad when mature, heavy-fleshy, convex to expanded, sometimes umbonate, pallid or more often cervine or wood-brown, the cuticle sometimes weathering off to a white color, subviscid, with scattered, large, white, floccose patches or squamules that are rather adnate and sometimes imbricate and may disappear, or with soft white scales; margin frequently rivulose and with white fibrils or fibrillose scales; flesh white, thick, odor not marked, taste mild or saponaceous; gills adnate to sinuate, close or crowded, at first white, finally deep cinnamon, 4–14 mm. broad; veil white, soon breaking, forming an evanescent, white, floccose-tomentose annulus; stem central or excentric, equal or enlarged downward, white floccose-tomentose above the annulus, with a few large white squamules or indistinctly and broadly peronate from the veil fibers, white to wood-brown, 5–15 cm. long, 1–6 cm. thick, solid; spores ovoid or ellipsoid, smooth, 7.5–9.5 × 4–6 μ; cystidia none.



Figs. 170–171. *P. destruens:* 170, section of hymenium with spores (a), × 550; 171, spores, × 1200. All from specimens at New York from Kansas by Bartholomew.

Habitat: on stumps and trunks of *Populus* and other deciduous trees.

Distribution: specimens have been examined from Charlotte, Pittsford, Knowersville, and Utica, N. Y.; Oxford, Ohio; River Forest, Ill.; Indianapolis, Ind.; St. Louis, Mo.; Kansas; Denver and Boulder, Colo.; Priest River, Idaho; Sequim, Wash.; also reported by Harper from Frankfort, Mich. (as *P. heteroclita* and *P. comosa*).

Illustrations: Bresadola, Fung. Trid. *pl. 84;* Hard, Mushrooms, *f. 214;* Harper, Trans. Wis. Acad. Sci. **17:** *pl. 45–47;* Kalchbrenner, Ic. Hym. Hung. *pl. 13, f. 1* (as *P. comosa*).

Bresadola considers *P. comosa* and *P. heteroclita* as synonyms of this species, and he has been followed in this country by Kauffman. Harper, on the other hand, describes and illustrates *P. comosa* from Michigan and Illinois as covered with small white innate fibrils that become separated into small appressed scales, while his *P. heteroclita* seems to compare better with the plants I have referred to *P. destruens.* At best these plants are all very closely related and specific limitations are largely a matter of individual opinion.

Notes on a collection made near St. Louis by Glatfelter describe the taste as sweet at first, becoming bitter.

Supplementary Key to the Species

1. Spores rough at maturity (either distinctly so under the high power of the microscope or requiring the use of the oil-immersion lens) 2
   Spores smooth at all stages 9
2. Wood-inhabiting;[1] fresh plants bright-colored, i.e., some shade of yellow, green, or red; gills frequently bright-colored; not viscid; spores 6–10 μ long; cystidia not noteworthy 3
   Wood-inhabiting;[1] gills not bright-colored but cinnamon; spores mostly 6–10 μ long; cystidia present though not always abundant, flask-shaped with a projecting neck 6
   Ground-inhabiting, in woods; spores variable, but in all species except one more than 10 μ long 7
   Among *Polytrichum* moss on the ground; very small plants, less than 1 cm. broad; stem 1–2 mm. thick ..... *P. minima*
3. Pileus with distinct shades of green or ashy-green when young or on being handled; flesh green-tinged; gills bright-colored (yellow to ochraceous-orange) and remaining so in dried plants; pileus scaly with fibrillose scales ..... *P. aeruginosa*
   Plants not *entirely* as above 4
4. Pileus 2–5 cm. broad, typically pinkish-red in color, squamulose with innate scales (i.e., not formed by the separating of a fibrillose cuticle on the pileus); flesh usually pale lavender; gills bright-colored in dried plants ..... *P. luteofolia*
   Plants not entirely as above 5
5. Pileus 4–15 cm. broad at maturity, dry, glabrous or fibrillose, or if somewhat squamulose then the scales definitely formed by the separation of a fibrillose cuticle; taste bitter or amygdaline ..... *P. spectabilis*

[1] Plants found growing in clusters from a common point, apparently on the ground, are likely to be attached to buried wood, but this point should be carefully investigated when making the collection.

Pileus hygrophanous, glabrous, otherwise as in *P. spectabilis*.....*P. cerasina*

6. Plants hygrophanous (never viscid), watery-brown and striatulate on the margin when moist, ochraceous on drying, cinnamon to tawny in herbarium specimens, not at all scaly; gills simple; annulus soon evanescent or leaving only a band on the stem.....*P. marginata*

Plants as above except pileus viscid, annulus sometimes persistent, and dried plants cinnamon-buff to cinnamon.....*P. discolor*

Plants as in *P. marginata* except annulus membranous, persistent, conspicuous.....*P. unicolor*

Plants as in *P. marginata* except gills distinctly forking.....*P. furcata*

7. Spores broadly-ovoid to subglobose, 7–9 × 5–6 μ, distinctly verrucose; pileus entirely covered with matted floccose fibrils, or these collected into squamules at the center of the pileus; plants with somewhat the aspect of *Cortinarius*.....*P. trachyspora*

Spores ellipsoid or elliptic, more than 12 μ long, distinctly verrucose.....8

8. Plants slimy-viscid, glabrous; gills not conspicuously banded with alternating light and dark transverse bands; plants western....*P. Mcmurphyi*

Pileus scarcely moist or sub-viscid, young plants with a coating of hoary fibrils; gills conspicuously banded with transverse light and dark bands, particularly in dried plants; plants eastern.....*P. caperata*

9. Plants growing on the ground[1] and with *either* pileus or stem *or both* scaly....10

Plants growing on the ground[1] or among moss and with *neither* pileus nor stem scaly, or at most only floccose or scurfy.....17

Plants growing on wood[1] and with *either* pileus or stem *or both* scaly or with floccose patches.....35

Plants growing on wood[1] and with neither pileus nor stem scaly.....52

10. Stem scaly.....13

Stem not scaly or at most only strongly floccose or scurfy.....11

11. Spores constantly 6 μ or less long; annulus membranous, disappearing .....*P. duroides*

A considerable number of spores in each mount measuring as much as 8 or 9 μ long; annulus a persistent cottony roll on the stem.....12

Spores 9–12 μ long; annulus membranous, disappearing.....*P. aurea*

12. Pileus brown, ochraceous-brown, or ochraceous-tawny, minutely scaly all over; annulus slight, evanescent.....*P. angustipes*

Pileus ochraceous to pallid, minutely scaly only at the center; annulus a persistent cottony roll on the stem .....*P. Johnsoniana*

13. Sterile organs of conspicuous form or color entirely lacking from the hymenium; pileus and stem covered with a fibrillose cuticle that soon separates into soft silky scales on both pileus and stem.....14

Sterile organs present in the hymenium, sometimes projecting but sometimes with the aspect of over-mature basidia, and brown in color and not projecting; plants not otherwise as above.....15

14. Spores 6–8 μ long, rather strongly apiculate.....*P. fulvo-squamosa*

Spores 8–9 μ long, not apiculate.....*P. terrigena*

---

[1] Plants found growing in clusters from a common point, apparently on the ground, are likely to be attached to buried wood, but this point should be carefully investigated.

15. Scales of the pileus scattered, appressed, sometimes all but disappearing, rather large; cystidia as brown sterile organs, some imbedded but many projecting, of definite form; pileus yellow or buff.....*P. rigidipes*
Scales of the pileus numerous, small, and appearing as black dots to the unaided eye, or medium-sized and more conspicuous; cystidia not as above.....16
Scales of the pileus none; cystidia abundant, projecting, flask-shaped.*P. subnigra*
16. Cystidia occasional, not of definite form but mostly as inconspicuous brown organs comparable to post-mature basidia, but usually not projecting; pileus pale brown or pinkish-cinnamon, 3–7 cm. broad..*P. angustipes*
Cystidia abundant, projecting, sharp-pointed, many hyaline or with rounded brownish globules inside; plants dark brown, 1–3 cm. broad .....*P. terrestris*
Cystidia rather numerous, projecting, fusoid, hyaline; plants 5–8 cm. or more broad when mature, ochraceous-buff.....*P. Schraderi*
17. Spores ovoid or narrow-ovoid with a truncate apex and base more or less obtuse or rounded though sometimes apiculate.....18
Spores variously shaped, not truncate at the apex but sometimes apiculate at the base.....27
18. Spores narrow-ovoid, 4–5 μ broad, or else annulus median, conspicuous, striate on the upper side; cystidia none; slender plants not more than 4 cm. broad.....19
Plants not entirely as above.....23
19. Plants growing in wet places among *Sphagnum* moss.....*P. mycenoides*
Plants not as above.....20
20. Plants watery-brown, ochraceous in herbarium specimens; stem 2–10 cm. long.....21
Plants yellowish-red or dark ferruginous and retaining these colors in herbarium specimens; stem 1–2.5 cm. long.....*P. rugosa*
21. Spores 6.5–9 μ long.....*P. blattaria*
Spores 9–10.5 μ long.....22
22. Stem 2 mm. or more thick; medium-slender plants more than 1 cm. broad .....*P. togularis*
Stem about 1 mm. thick; very slender plants less than 1 cm. broad....*P. filaris*
23. Plants growing on the ground in cultivated fields or grassy places, or in open grassy woods, or among straw or other waste vegetable matter carried into the woods.....24
Plants growing on the ground in dense woods, or growing on wood.....26
24. Spores 10–14 μ long; cystidia scarcely projecting, the apex broadly rounded; pileus white, soon areolate.....*P. vermiflua*
Plants not entirely as above; spores 8–10.5 μ long; cystidia flask-shaped and projecting conspicuously if present.....25
25. Spores 4–6 μ broad; pileus white or tinged with yellow or tan; gills narrow or medium-broad.....*P. praecox*
Spores 6–7 μ broad; pileus ochraceous-yellow; gills very broad....*P. temnophylla*
26. Plants growing on wood or on rich humus; pileus rugose at times.*P. Acericola*
Plants growing on the ground; pileus never rugose.....*P. Howeana*
27. Spores up to 9 μ long.....28
Spores more than 9 μ long.....33

28. Plants growing among *Polytrichum* moss, small, less than 1 cm. broad; spores finely verrucose under the oil-immersion lens.....*P. minima*
Plants not entirely as above.....29
29. Plants small or medium-sized, less than 4 cm. broad; cystidia none or not noteworthy.....30
Plants larger; cystidia various, sometimes absent.....31
30. Annulus median, long-persistent, striate on the upper surface....*P. blattaria*
Annulus superior, evanescent.....*P. anomala*
31. Plants western; pileus slimy-viscid; stem conspicuously white-tomentose just below the annulus.....*P. albivelata*
Plants eastern; pileus dry; stem not white-tomentose.....32
32. All spores 6 μ or less long; cystidia rather abundant but not conspicuous, mostly with a mucronate tip; annulus membranous, disappearing.*P. duroides*
Some spores in every mount as much as 8 or 9 μ long, mostly 5–9 μ; cystidia quite rare and scarcely noteworthy, or abundant and conspicuous; annulus a cottony roll on the stem.....*P. Johnsoniana*
33. Plants small, less than 2 cm. broad.....*P. subnigra*
Plants larger, 2–10 cm. broad.....34
34. Plants 2–5 cm. broad; gills adnate or slightly decurrent; stem fibrillose below the annulus.....*P. erebia*
Plants as above, but stem concentrically white-zoned from the veil.*P. platyphylla*
Plants 4–10 cm. broad; gills distinctly decurrent.....*P. ombrophila*
Plants 10–15 cm. broad; gills 7–20 mm. broad, rounded behind.....*P. aurea*
35. Spores 9 μ or less long, or if somewhat longer, then pileus glabrous.....36
Spores 9–11 μ long, oblong-ellipsoid; brown sterile organs present in the hymenium; plants western; pileus scaly.....*P. aurivelloides*
Spores 11–14 μ long, broadly-elliptic or fusoid-elliptic; brown sterile organs absent from the hymenium; plants eastern; pileus scaly.*P. albocrenulata*
36. Stem only scaly and spores with a truncate apex; small plants up to 3 cm. broad; no sterile organs in the hymenium.....*P. mutabilis*
Plants not entirely as above.....37
37. Spores 3–6 μ long.....38
Spores 6 μ and more long.....39
38. Pileus pallid to cinnamon when fresh, viscid, densely scaly with erect or sub-erect, pointed, concolorous scales; stem with concolorous scales .....*P. squarrosoides*
Pileus lemon-yellow to tawny or fiery-yellow when fresh, dry, with fibrillose, superficial, sulphur-yellow scales; the stem with yellow floccose scales or scarcely more than yellow flocci.....*P. flammans*
39. Plants pallid to brown, grayish-brown, or ochraceous-brown; pileus squamulose, with abundant minute dot-like appressed scales, never areolate, 3–7 cm. broad; stem only slightly, if at all, scaly; no conspicuous projecting sterile organs[1] in the hymenium; spores 6–8 μ long. .....*P. angustipes*
Plants ochraceous-buff to ochraceous-tawny; pileus glabrous; gills somewhat distant, strongly interveined; stem 8–20 mm. thick, with small subfloccose evanescent scales; spores 7.5–9.5 μ long.....*P. oregonense*

[1] But there are usually present more inconspicuous bodies, not projecting, and with the appearance of old basidia, irregular in shape. These are apt to show up particularly well in permanent sections in glycerine.

Plants not *entirely* as in either of the above.....40
40. Hymenium with numerous sterile brown organs, imbedded or projecting; all species bright-colored, yellow, reddish, or tawny, and with both pileus and stem scaly, and pileus more than 5 cm. broad.....41
Hymenium with distinct projecting hyaline fusoid cystidia; pileus appressed-squamose and often areolate; stem squamulose.....*P. Schraderi*
Hymenium without sterile brown organs or cystidia except perhaps on the edges of the gills; other characters variable.....44
41. Pileus with large appressed spot-like scales; stem increasingly scaly downward.....*P. aurivella*
Plants not entirely as above.....42
42. Pileus viscid.....*P. adiposa*
Pileus dry.....43
43. Pileus with appressed scales; stem only inconspicuously scaly, 4–6 mm. thick.....*P. rigidipes*
Pileus with recurved scales; stem conspicuously scaly with recurved scales and 5–12 mm. thick.....*P. squarrosa*
44. Large species, 6–15 cm. broad, white to pallid or wood-brown, with large white floccose spots or patches on the pileus; spores 7.5–9.5 μ long..*P. destruens*
Large species 6–12 cm. broad, with fibrillose scales; plants growing at the base of trees or attached to buried wood; spores 6–8 μ long, strongly apiculate.....*P. fulvo-squamosa*
Plants not entirely as above.....45
45. Both pileus and stem scaly.....46
Pileus only scaly.....49
46. Pileus deep rich brown or golden brown to tawny.....47
Pileus brighter-colored, lemon-yellow to ochraceous-orange.....48
47. Both pileus and stem densely covered with a sheath of small erect, conical, superficial scales.....*P. erinaceella*
Pileus covered with a dense coating of soft fibrillose scales that are erect, if at all, only in the center of the pileus; stem sparingly scaly or only fibrillose, not sheathed.....*P. muricata*
48. Stem with a distinct bulb just at base; not sheathed but scaly...*P. tuberculosa*
Stem not with a bulb at the base, but sheathed and scaly.....*P. lucifera*
Stem not with a bulb at the base; not sheathed but scaly.....*P. limonella*
49. Pileus 1–2.5 cm. broad, hygrophanous; gills cinnamon; annulus distinct, persistent, membranous.....*P. confragosa*
Pileus 2–10 cm. broad; gills bright ochraceous-orange; annulus fibrous-lacerate and evanescent.....50
50. Pileus viscid.....*P. lucifera*
Pileus dry.....51
51. Pileus soon areolate and often with greenish tints; edge of gills concolorous .....*P. aeruginosa*
Pileus not areolate, never greenish; edge of gills conspicuously white-crenate.....*P. curvipes*
52. Pileus floccose or silky-floccose, 2–5 cm. broad; gills, pileus, and stem bright ochraceous-orange.....*P. curvipes*
Plants not entirely as above.....53
53. Plants uniformly less than 4 cm. broad.....54

Plants at maturity more than 4 cm. broad.....56
54. Spores with a truncate apex, 6–8 μ long; cystidia none; veil evanescent .....*P. marginella*
Spores not truncate, 7.5–9.5 μ long; flask-shaped cystidia present and projecting, though not abundant.....55
55. Pileus viscid; annulus subpersistent.....*P. discolor*
Pileus dry; annulus at first funnel-shaped, persistent and conspicuous .....*P. unicolor*
Pileus dry; annulus usually persistent but not funnel-shaped....*P. marginata*
56. Pileus ochraceous to tan; annulus long-persistent, membranous.....57
Pileus bright-colored, ochraceous-buff to tawny; annulus soon evanescent; gills rather distant and the gill cavities strongly veined.....*P. oregonense*
57. Cystidia rather abundant, flask-shaped, strongly projecting; pileus often rugose; on rotten wood or on humus.....*P. Acericola*
Cystidia present and rather abundant but projecting only slightly and more fusoid than flask-shaped; on recently felled logs or from wounds of living trees.....*P. Aegerita*

SYNONYMS AND DOUBTFUL AND EXCLUDED SPECIES

Pholiota aggericola Peck is *P. erebia* of this paper. See p. 119.

Pholiota appendiculata Peck, Bul. N. Y. State Mus. **94:** 33. 1905. = *P. ornella* Peck, which is referable to *Flammula polychroa* Berk.

Pholiota autumnalis Peck is *P. marginata* (Batsch) Fries. See p. 134.

Pholiota dactyliota (Berk. & Mont.) Sacc. Syll. Fung. **5:** 750. 1887 (*Agaricus dactyliotus* Berk. & Mont.; Mont. Syll. Crypt. 115. 1856). Described from plants collected in Ohio by Sullivant, and said to be similar to *P. squarrosa.*

Pholiota comosa Fries is here regarded as a form of *P. destruens* Brand. See p. 169.

Pholiota detersibilis Peck is *P. erinaceella* Peck. See p. 161.

Pholiota dura (Bolt.) Quel. Champ. Jura Vosg. 91. 1872 (*Agaricus durus* Bolt. Hist. Fung. *pl. 67, f. 1.* 1788). A species reported in every list of fleshy fungi issued in America. All collections examined belong as well under *P. vermiflua* Peck which will probably be found to be a synonym of *P. dura.* Europeans are far from an agreement as to the limits of the species and Peck's name can be used for the present. See p. 105.

Pholiota heteroclita Fries is here regarded as not distinct from *P. destruens* Fries. See p. 169.

Pholiota hormophora (Mont.) Sacc. Syll. Fung. **5:** 754. 1887

(*Agaricus hormophorus* Mont. Syll. Crypt. 116. 1856). Collected by Sullivant in Ohio and described by Montagne. Said to resemble *P. tuberculosa* Fries and is described as having a bulbous enlargement at the base of the stipe.

Pholiota indecens Peck is *P. ombrophila* Fries. See p. 121.

Pholiota lutea Peck is here treated as a form of *P. spectabilis* Fries. See p. 145.

Pholiota luxurians (Fries) Gill. Champ. Fr. 439. 1876. Reported by Harper from the Great Lakes region. The specimen seems to be related to *P. aeruginosa* Peck.

Pholiota mollicula Banning in Peck, Rept. N. Y. State Mus. **44:** 182 (70). 1891. Originally described from Maryland, growing on the roots of trees.

Pholiota ornella Peck, Bul. N. Y. State Mus. 122: 151. 1908 (*Agaricus ornellus* Peck, Rept. N. Y. State Mus. **34:** 42. 1883). Not distinct from *Flammula polychroa* Berk.

Pholiota radicosa (Bull.) Quel. Champ. Jura Vosg. 92. 1872 (*Agaricus radicosus* Bul. Herb. Fr. *pl. 160.* 1783). Reported from the Pacific coast by Harkness and Moore but I have seen no specimens of this highly characteristic species.

Pholiota sabulosa Peck, Bul. Torr. Bot. Club **23:** 414. 1896. Described as growing in sandy soil in Alabama. The spores are rough-walled, 8.5–9.5 × 5–6 μ. Flask-shaped cystidia project from between the basidia. Both of these characters ally the plant to the *P. marginata* complex in which there is already an overabundance of described species. Specimens in the Underwood Herbarium at New York show the plant to have been growing from humus-charged earth, and it is probably to be regarded as a form of *P. marginata* or *P. discolor*.

Pholiota speciosa Clements, Bot. Surv. Neb. **2:** 41. 1893. The description is inadequate for the recognition of the species. If the spore measurements (5 × 4.5 μ) are correctly recorded it would fall in the neighborhood of *P. duroides*, with which it seems to have other characters in common.

Pholiota sphaleromorpha (Bull.) Quel. Champ. Jura Vosg. 91. 1872 (*Agaricus sphaleromorphus* Bull. Herb. Fr. *pl. 540.* 1791). Harper is of the opinion that *P. Howeana* Peck is referable to this species. At all events it is very similar and there are now too

many species described with the peculiar truncate spores, the prominent cystidia, and other characters common to this group. See p. 109, 111.

Pholiota subsquarrosa (Fries) Sacc. Syll. Fung. **5**: 750. 1887. Reported by McIlvaine. I have seen no specimens so referable, and McIlvaine records that the plants seem different from the European species. See p. 151, 156.

Pholiota terrigena (Fries) Sacc. Syll. Fung. **5**: 737. 1887. The species has been reported from the United States but I have seen no material that corresponds to specimens from Bresadola. The plants so recorded should be compared with *P. terrestris* Overholts, which has smaller spores and prominent cystidia. See p. 127.

Pholiota ventricosa Earle is *P. spectabilis* Fries. See p. 146.

Pholiota villosa (Fries) Sacc. Syll. Fung. **5**: 752. 1887. Specimens so determined by Peck and similar collections from the Pacific coast seem referable to *P. spectabilis*.

Pholiota washingtonensis Murrill, Mycologia **4**: 259. 1912. Seems to be unquestionably *P. ombrophila*. See p. 121.

INDEX TO SPECIES

New species are printed in **bold face** type; synonyms and less important binomials in *italics;* and previously published valid names in ordinary type.

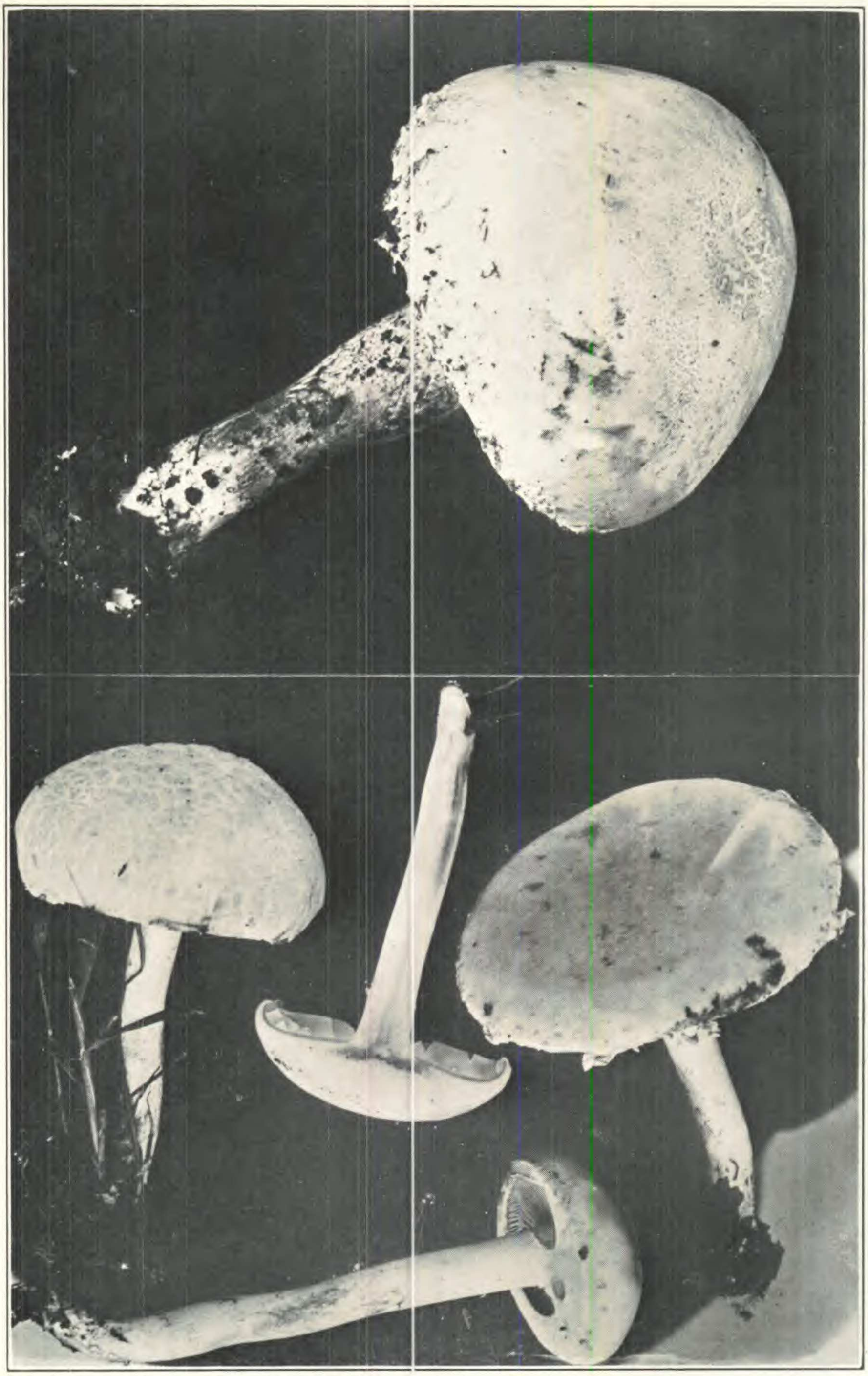
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Explanation of Plate

PLATE 8

P. vermiflua. Photo of specimens in Overholts Herb. 3248, × 2/3. Original.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 9

P. praecox. Photo of specimens in Overholts Herb. 3318. Upper half, × 3/5, lower half, × 4/5. Original.

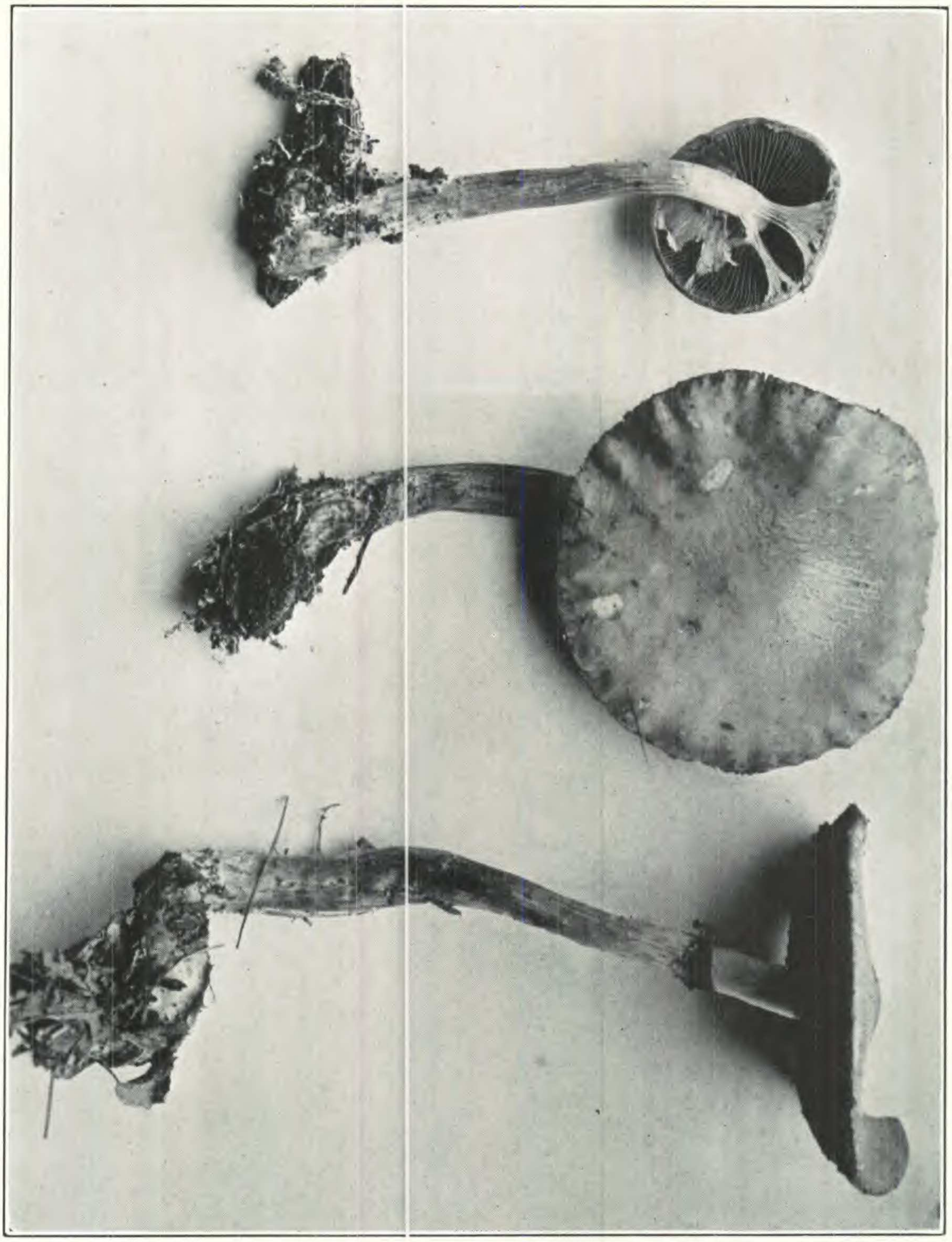


OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 10

P. Acericola. Photo of specimens in Overholts Herb. 3911, × 3/4. Photo by E. T. Kirk.

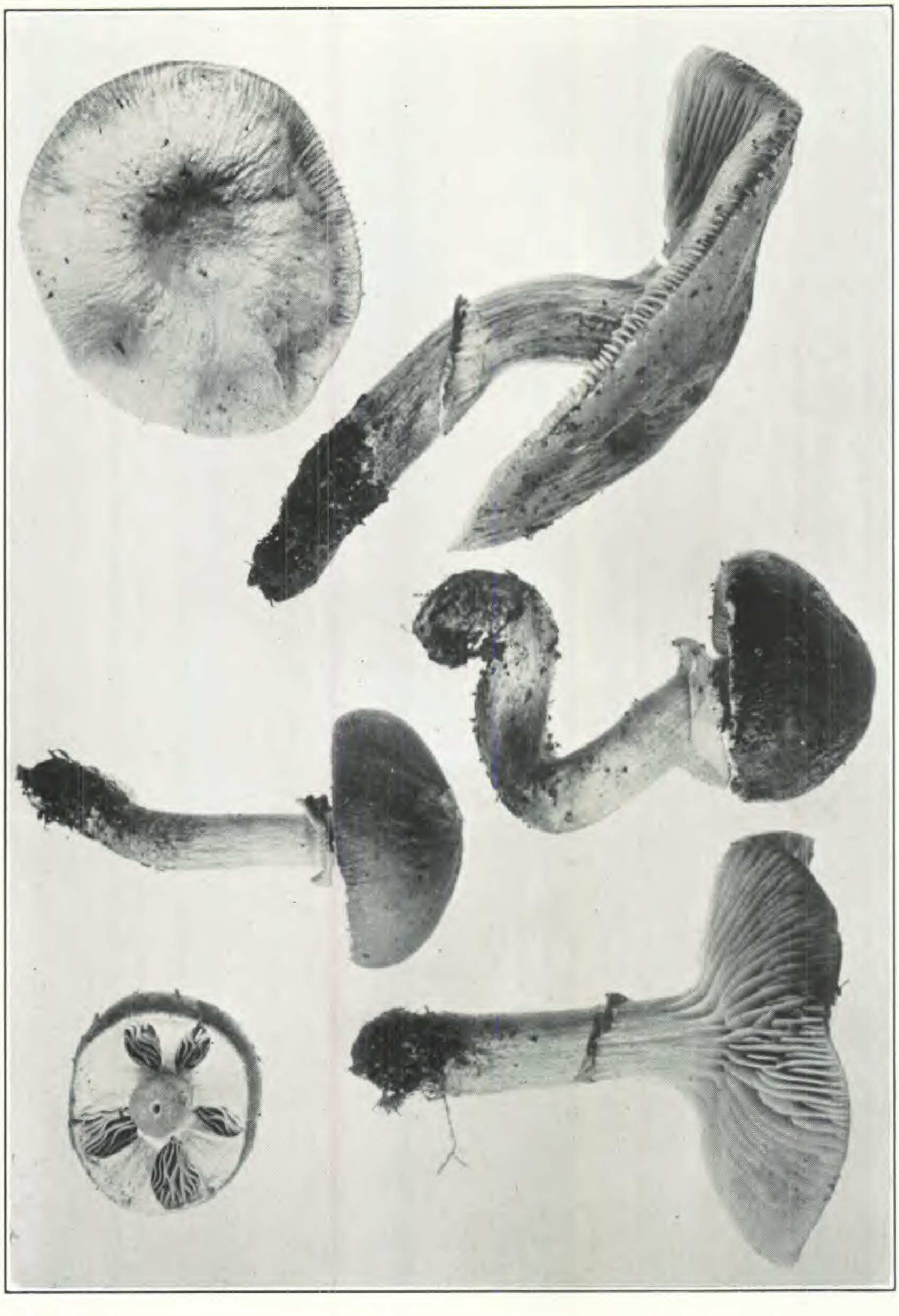


OVERHOLTS—PHOLIOTA IN THE UNITED STATES

EXPLANATION OF PLATE

PLATE 11

P. erebia. Photo furnished by E. T. Harper from plants collected in Michigan. About natural size.

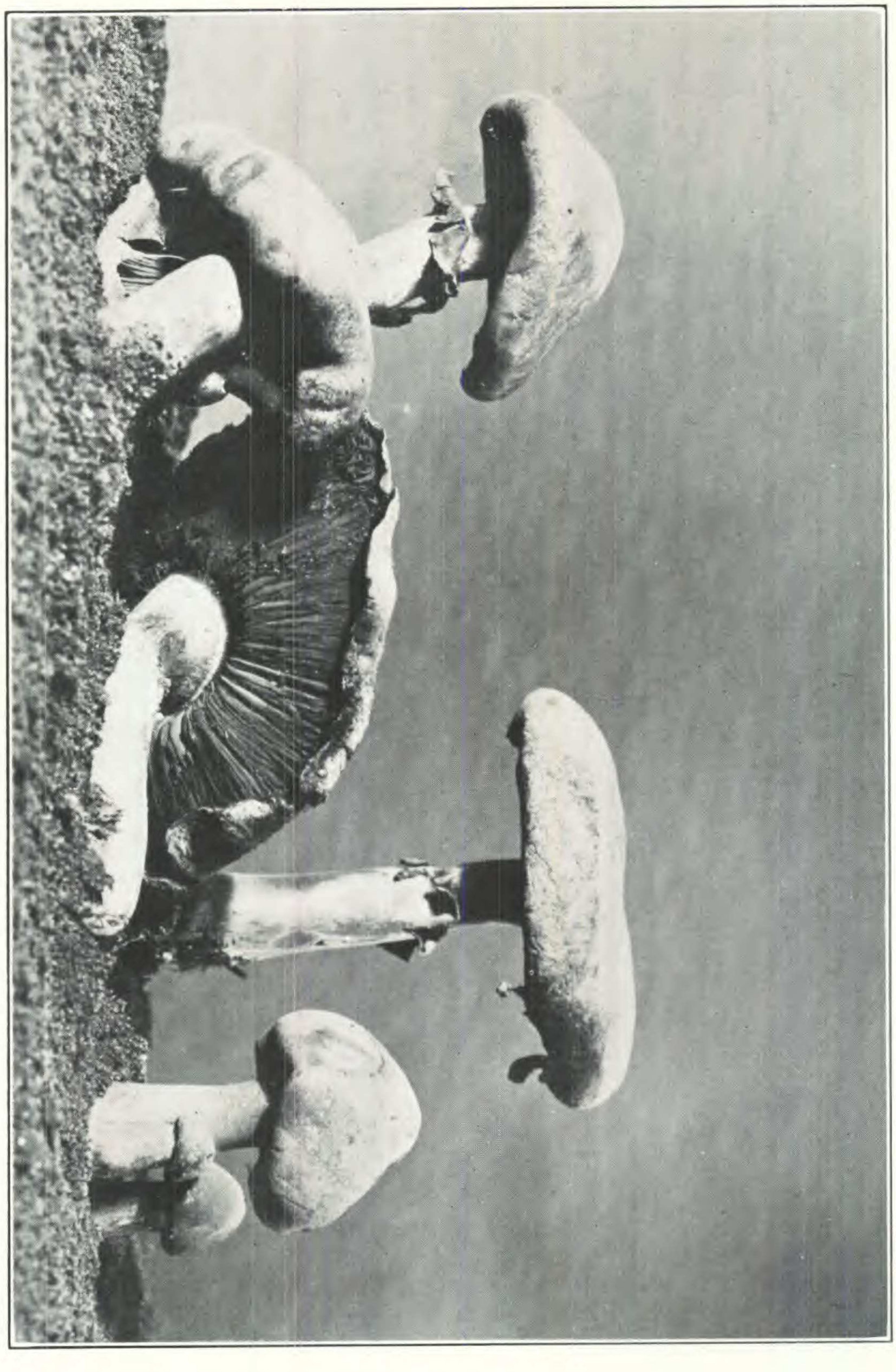


OVERHOLTS—PHOLIOTA IN THE UNITED STATES

EXPLANATION OF PLATE

PLATE 12

P. aurea. Photo of specimens in Overholts Herb. 8364, collected in British Columbia by J. Schmidt, October, 1922, and communicated by W. S. Odell. Photo by Drayton. Reduced.



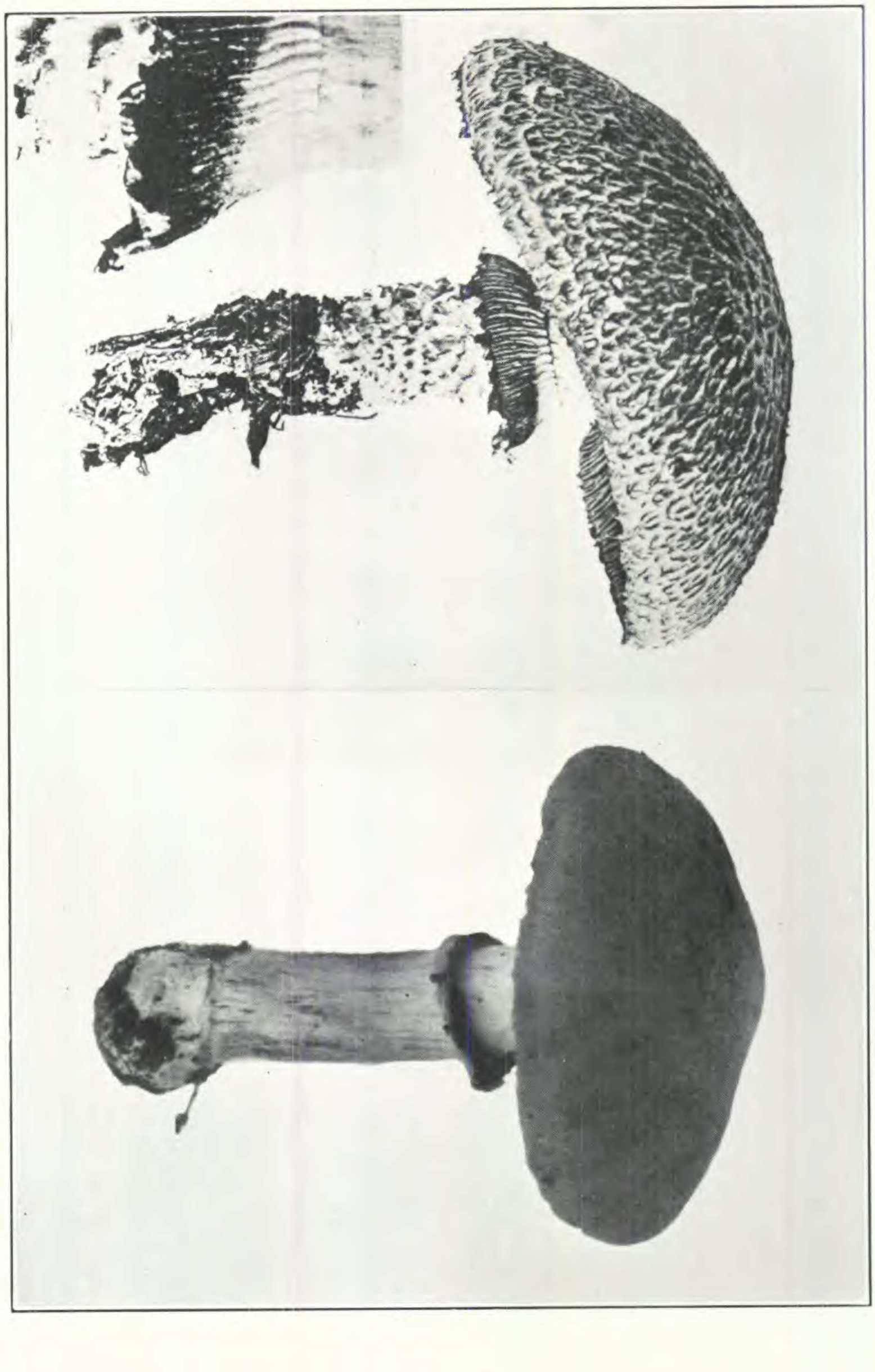
OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 13

P. fulvosquamosa (left half). From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 60.* 1913. About natural size.

P. caperata (right half). Photo of specimens in Overholts Herb. 7967, × 1. Small specimen. Original.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES

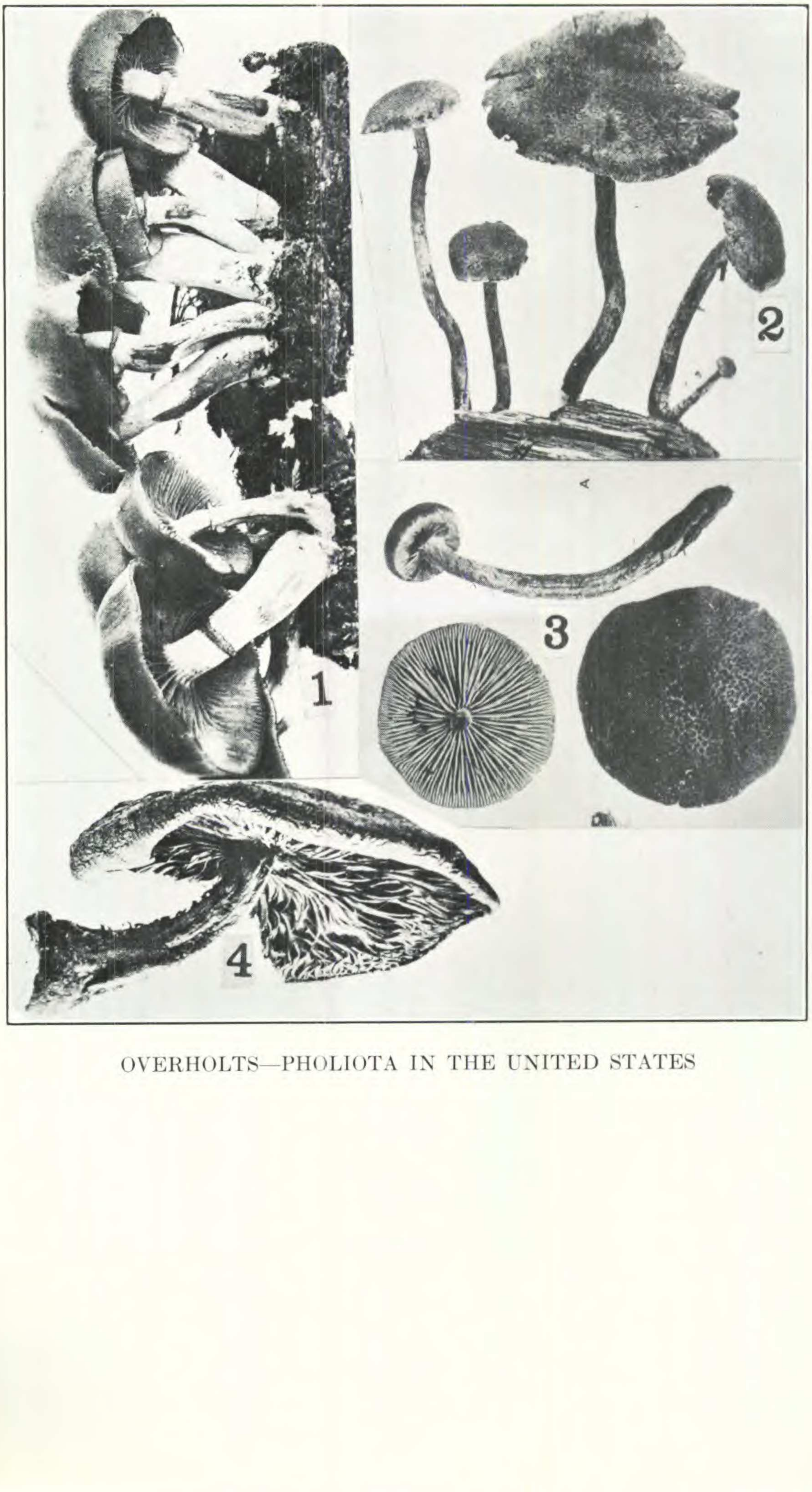
Explanation of Plate

PLATE 14

Fig. 1. *P. marginata.* From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 54, fig. C.* 1912. About natural size.

Figs. 2–3. *P. muricata.* From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 52, fig. A, B.* 1912. About natural size.

Fig. 4. *P. tuberculosa.* From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 41, fig. B.* 1912. About natural size.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES

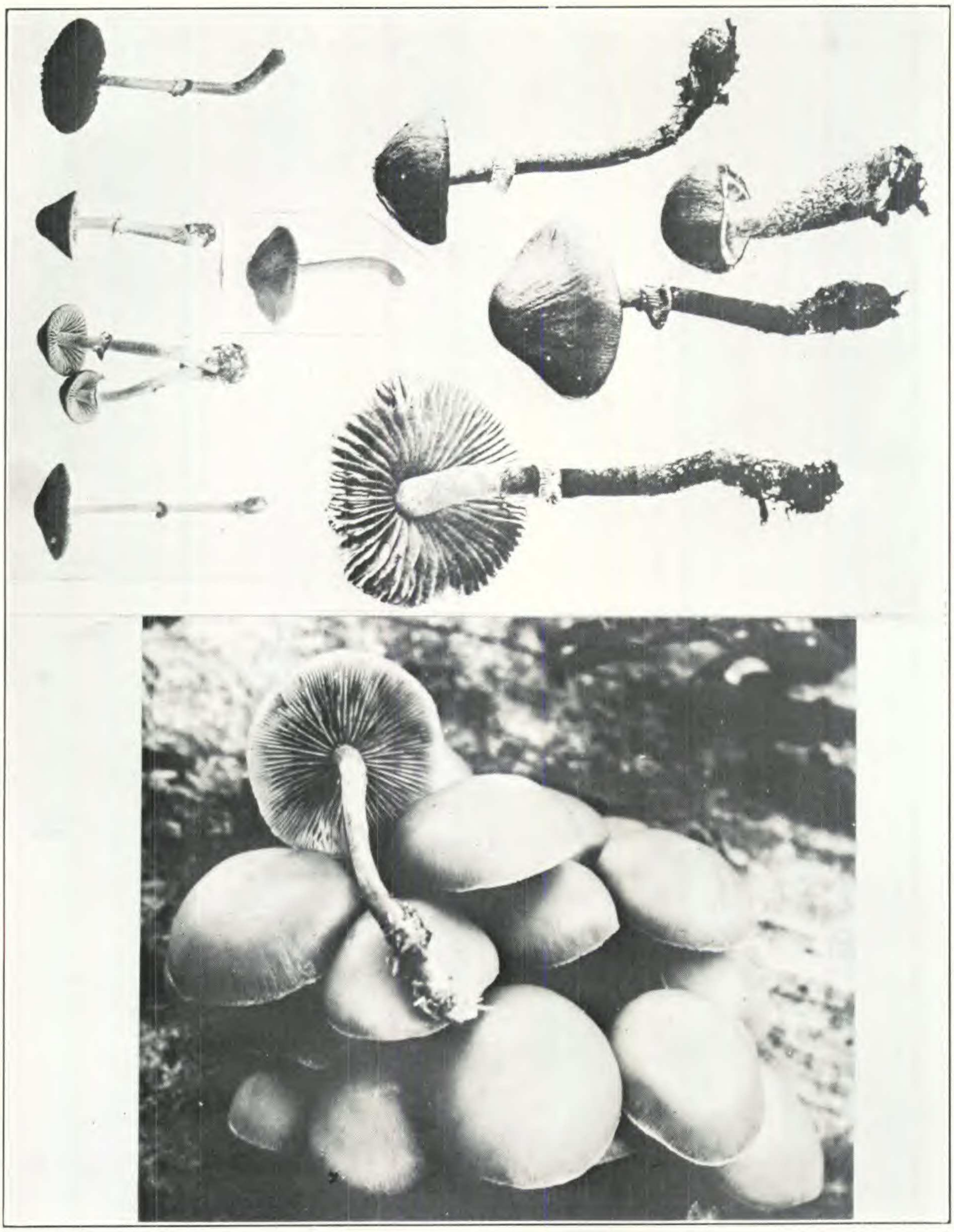
Explanation of Plate

PLATE 15

P. discolor (lower half). Photo of specimens collected in South Boulder Cañon, Colorado, July 18, 1923, elev. 10,000 ft. About natural size. Original.

P. rugosa (upper, left). Photo of specimens in Overholts Herb. 3623, × 1. Original.

P. togularis (upper, right). From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 59.* 1913. About natural size. (Published as *P. blattaria.*)



EXPLANATION OF PLATE

PLATE 16

P. spectabilis. Photo of specimens in Overholts Herb. 9889. Reduced somewhat. Photo by L. W. Brownell.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES

EXPLANATION OF PLATE

PLATE 17

P. spectabilis. Reduced somewhat. Photo by L. W. Brownell.

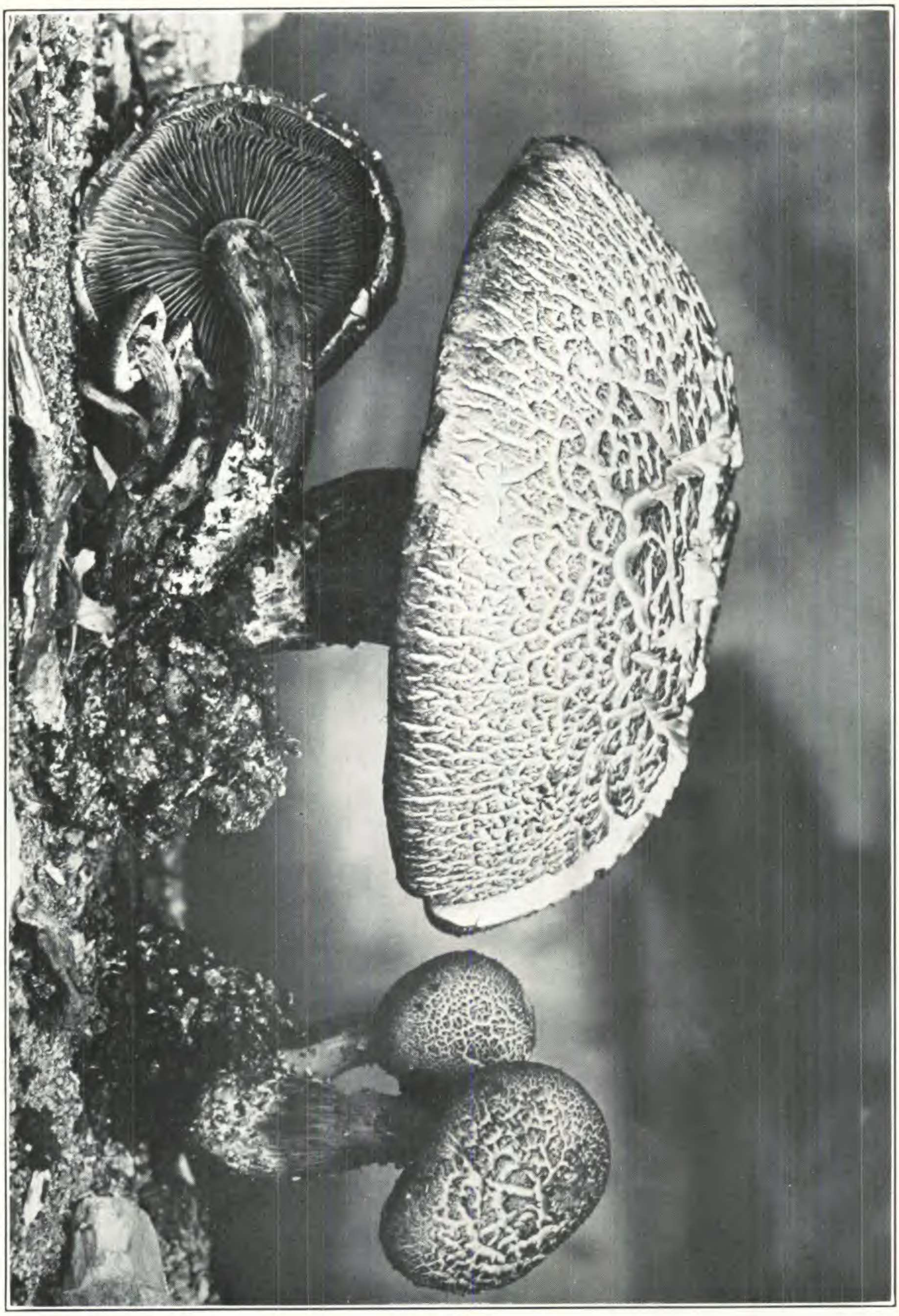


OVERHOLTS—PHOLIOTA IN THE UNITED STATES

EXPLANATION OF PLATE

PLATE 18

P. aeruginosa. About natural size. Photo by Burtt Leeper.



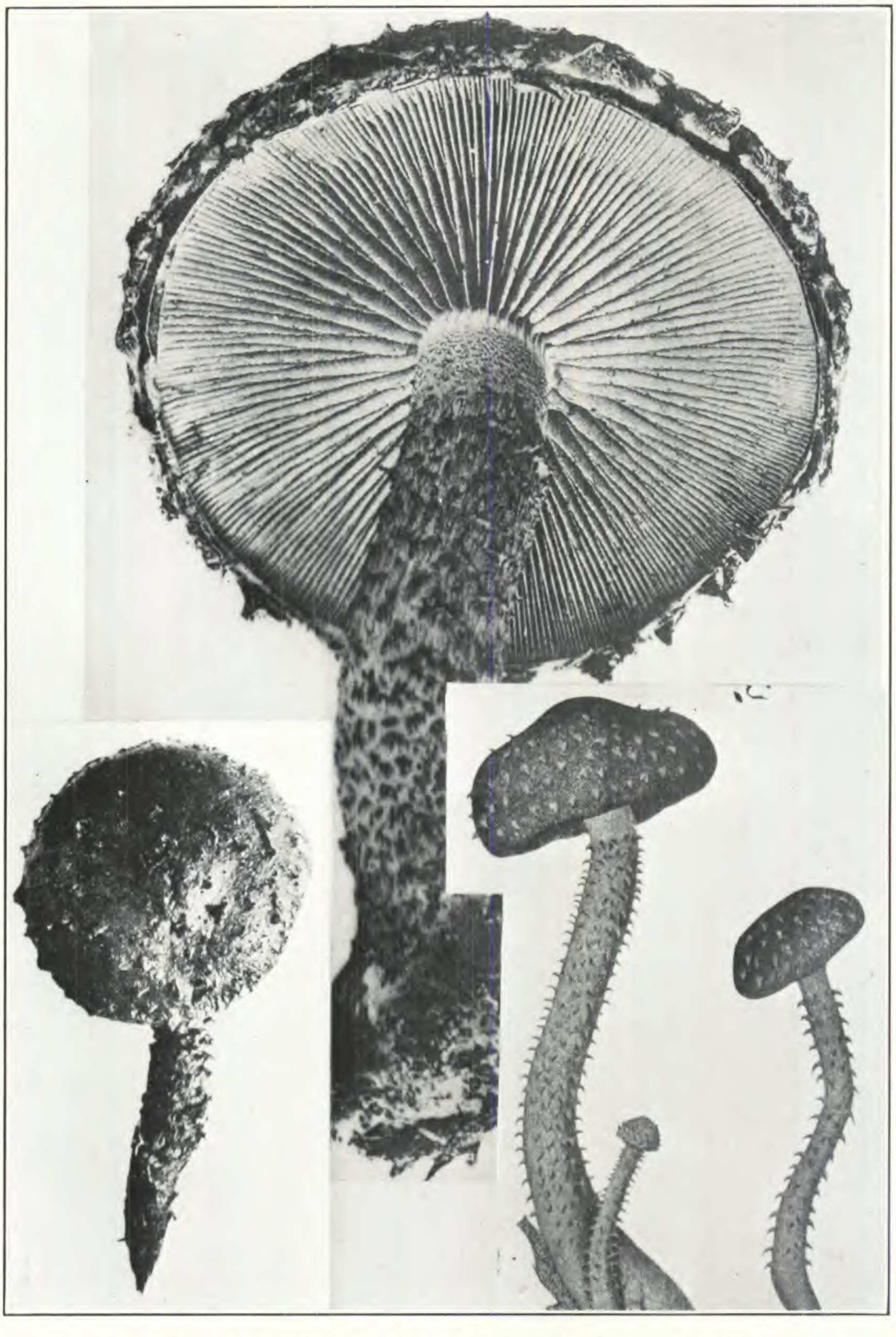
OVERHOLTS—PHOLIOTA IN THE UNITED STATES

EXPLANATION OF PLATE

PLATE 19

P. albocrenulata (upper part). From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 42.* 1912. About natural size.

P. flammans (lower part). Right, from Fries, Ic. Hym. *pl. 104, fig. 1;* left, from Harper, Trans. Wis. Acad. Sci. **17:** *pl. 41, fig. C.* Both about natural size.

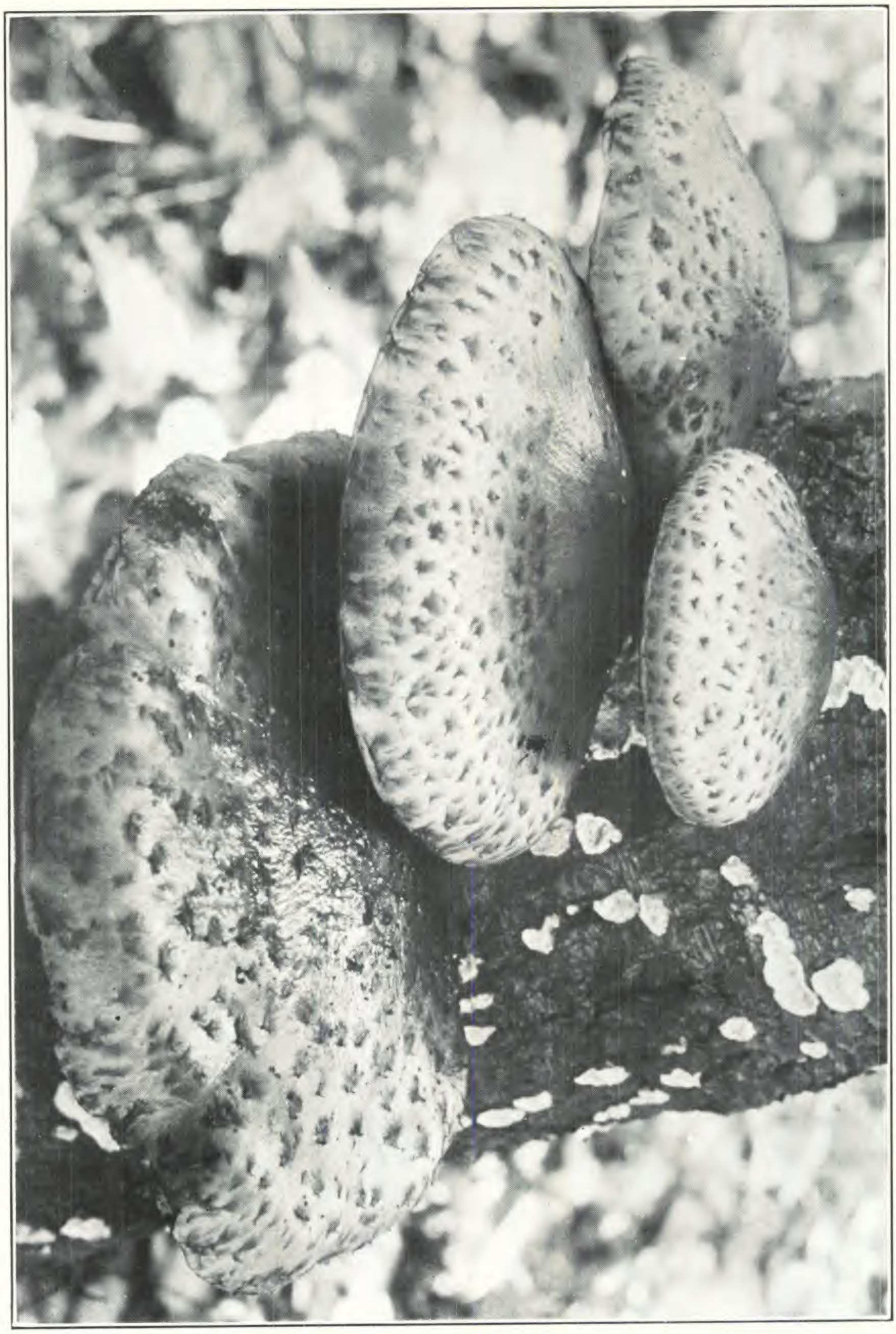


OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 20

P. adiposa. About natural size. Photo by L. W. Brownell.

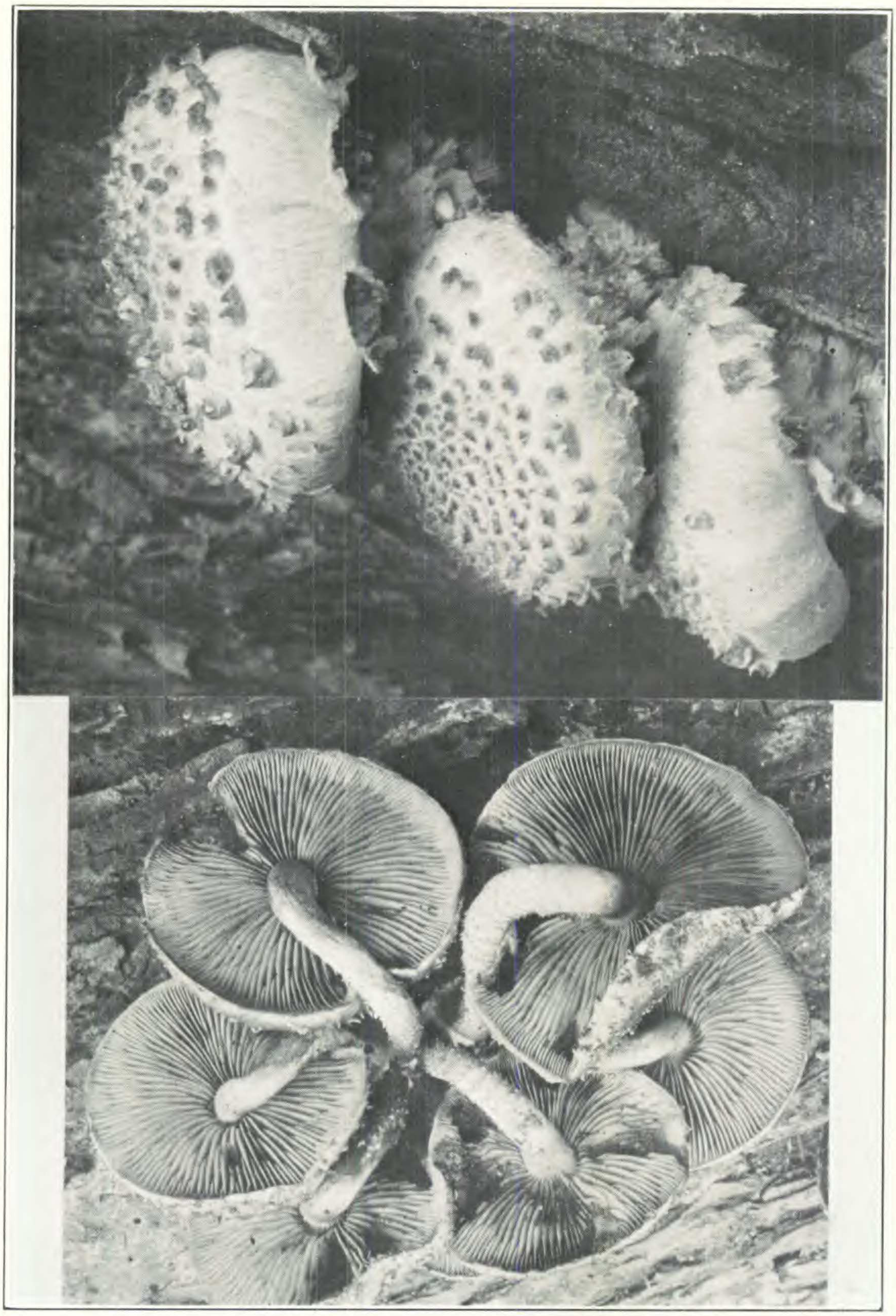


OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 21

P. squarrosa (upper half). About natural size. Photo by L. W. Brownell.
P. adiposa (lower half). About natural size. Photo by L. W. Brownell.



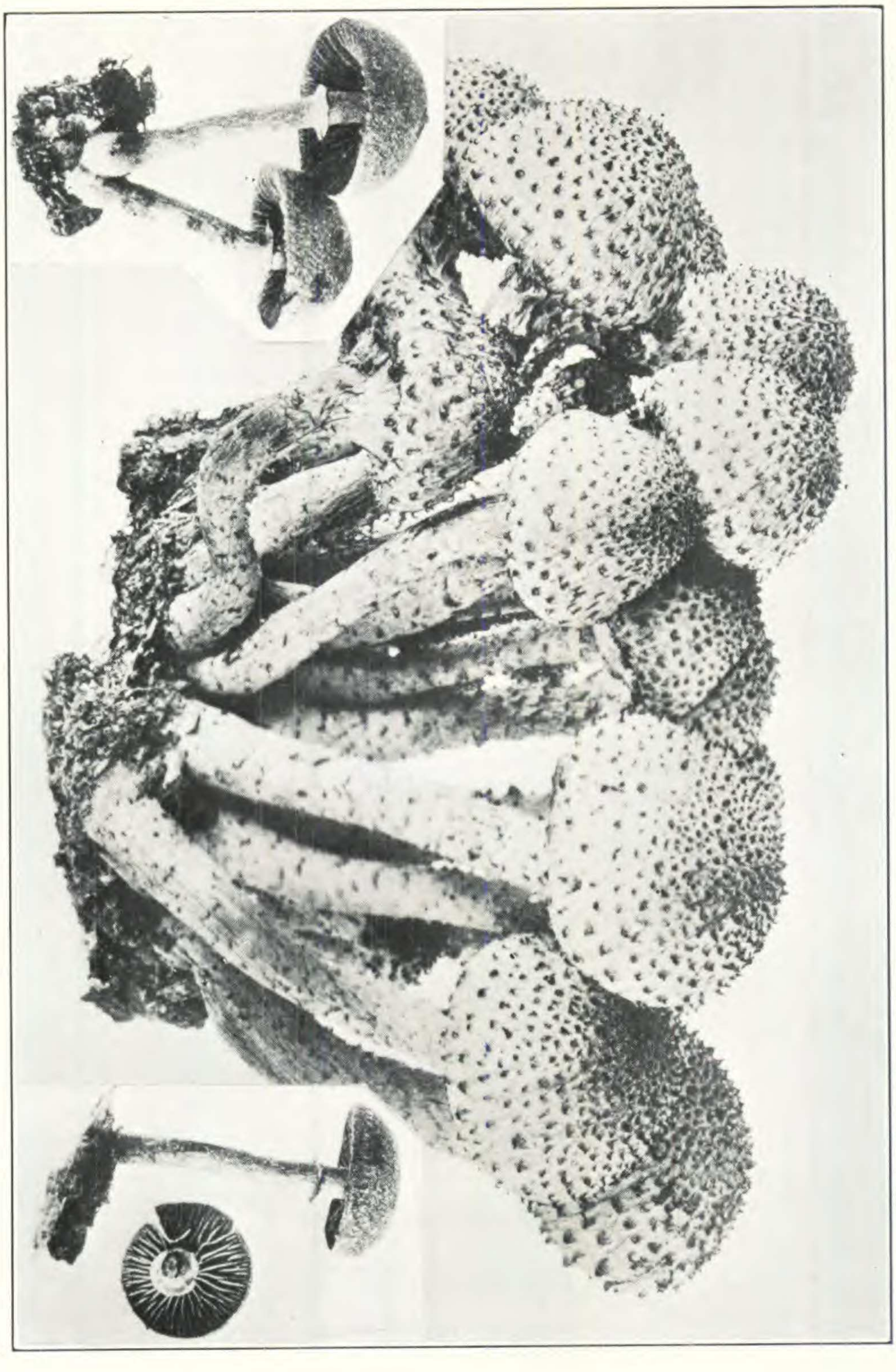
OVERHOLTS—PHOLIOTA IN THE UNITED STATES

EXPLANATION OF PLATE

PLATE 22

P. squarrosoides (large cluster). From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 36.* 1912. Slightly reduced.

P. confragosa (inserts). From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 41, fig. D.* 1912.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 23

P. angustipes (except lower left corner). From Harper, Trans. Wis. Acad. Sci. **17:** *pl. 34.* 1912. About natural size.

P. confragosa (lower left corner). Perhaps slightly enlarged. Photo presented by E. T. Harper.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES

Explanation of Plate

PLATE 24

P. aurivella. Somewhat reduced. Photo by L. W. Brownell.



OVERHOLTS—PHOLIOTA IN THE UNITED STATES